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The Foundry Industry in 1945

This time last year the country was heaving a sigh of relief, as the German break-through in Luxembourg and Belgium had been held, and the final collapse of Germany was obvious. This officially came about on May 8, to be followed in August by the unexpectedly early defeat of Japan. These, then, plus the incidence of the General Election, are the major factors which have influenced industry during 1945. For the ironfoundry section the last six months have been a period of reconversion. In a number of cases, the manufacture of steel castings has been discontinued; in others there has been an incessant struggle to return to pre-war lines of manufacture. For many firms this is proving an augean task. Labour had been dispersed and normal lines of manufacture discontinued, resulting in the closing down of such key shops as vitreous enamelling. No fewer than 28 are seeking a solution in major schemes of mechanisation. The tangles caused by the concentration of the ironfoundry industry in the London area are gradually being unravelled. Some foundries will never recommence, whilst others, whose premises have been destroyed, will not be allowed to re-establish themselves in the London district. The year has seen the establishment of the Joint Iron Council, with Mr. Arthur R. Knowles as its director, and with it a disclosure of the magnitude of the ironfounding industry. It can confidently be assumed that in peacetime the annual output of iron castings is of the order of three million tons. It is also of significance that for the first time for several decades the industry became front-page news in the daily Press, as a question in the House revealed that the shortage of iron castings was a bottleneck impeding industrial recovery. This has been followed by a broadcast pleading for voluntary recruitment to the industry.

The steel foundry section, after breaking all production records under the most adverse conditions during the war, is now making an orderly return to normal. Already a number of speciality shops have ceased the production of bombs, tank track links and turrets. Within a few weeks of VJ-Day we were able to report that the Sheffield steel foundries had changed over to an 85 per cent. peacetime production. As a culmination to a brilliant series of technical developments during the hostilities, we were able a few weeks ago, to announce a novel system of making castings quite sound by the use of a sort of "delayed action bomb."

The non-ferrous founders are not quite so well placed as the maufacturers of iron castings. There has been a very considerable falling off in orders in the magnesium section, a distinct slackening in aluminium division and patchy conditions in the brass and bronze shops, the shortage of orders from the Admiralty being the major factor in the last case. Whilst there has been a plethora of propaganda, especially by radio, to make this nation air conscious, we still await any concrete evidence of the quantity production of castings for civil aviation being launched. Nor do we see much of the activity promised as a result of the construction of aluminium houses. However, we are satisfied that these conditions are not the fault of the foundry section of the light alloy business or even the industry itself. The industry has appointed Air-Commodore W. Helmore, C.B.E., Ph.D., as the director of its development activities. He has the extremely difficult task of canalising a war-inflated industry into peacetime activities. We feel sure that at the new low levels of prices of the industry's raw materials much new ground can be won.

The Institute of British Foundrymen has continued to make astounding progress. It now possesses the largest membership of any British technical organisation having a metallurgical background. The meetings, both national and regional,

(*Continued overleaf, column* 2.)

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FORTHCOMING EVENTS

(Secretaries are invited to send in notices of meetings, etc., for inclusion in this column.)

JANUARY 5.

Institute of Welding (Eastern Counties branch):—"The Industrial Application of Automatic Submerged Arc Welding," by R. R Sillifant. At Ipswich.

Institute of Welding (South Wales branch):—"Oxygen Flame Cutting," by R. E. Doré. At Swansea.

JANUARY 10.

Institute of Welding (South London branch):—"The Application of Welding to Agricultural Machinery," by G. C. Bainbridge. At the County Technical College, Stoke Park, Guildford, at 7.30 p.m.

Institute of Welding (Eastern Counties branch):—"The Industrial Application of Automatic Submerged Arc Welding," by R. R. Sillifant. At Norwich.

Staffordshire Iron and Steel Institute:—"Steel Difficulties from the Users' Point of View," by W. R. Emerson. At the Dudley and Staffordshire Technical College, The Broadway, Dudley, at 7 p.m.

JANUARY 11.

Institute of Welding (Birmingham branch):—"Developments in the Technique and Use of Resistance Welding," by R. W. Ayers. At the James Watt Memorial Institute, Great Charles Street, Birmingham, 3, at 7 p.m.

JANUARY 18.

Keighley Association of Engineers:—"Arc Welding Problems," by H. F. Tremlett. At Devonshire Buildings, Devonshire Street, Keighley, at 7.30 p.m.

Institution of Mechanical Engineers:—"Recent Extensions to the Steam and Power Plant at a Large Chemical Works," by G. A. J. Begg, W. M. Hebblethwaite, and G. Cooke. "The La Mont Boiler," by G. A. Plummer. At Storey's Gate, St. James's Park, London, S.W.1, at 5.30 p.m.

JANUARY 21.

Sheffield Society of Engineers and Metallurgists:—Presidential address. At the Royal Victoria Station Hotel, Sheffield, at 6.15 p.m.

JANUARY 24

Association for Scientific Photography (Medical Group):—"Medical Photographer, or Photographing Medico," by B. Richardson Billings. At Hastings Hall, B.M.A. House, Tavistock Square, London, W.C.1, at 6 p.m.

JANUARY 25.

Manchester Association of Engineers:—"Colour as it Affects the Engineer in his Business of Everyday Life," by R. F. Wilson. At the Engineers' Club, Albert Square, Manchester, at 6.45 p.m.

Institute of British Foundrymen

JANUARY 5.

Lancashire branch:—"The Production and Treatment of Alloy Cast Irons," by G. W. Nicholls. At the Engineers' Club, Albert Square, Manchester, at 3 p.m.

JANUARY 9.

London branch:—Informal discussion on "Patent Laws as Affecting the Metallurgical Industry." At the Charing Cross Hotel, at 7.30 p.m.

JANUARY 12.

West Riding of Yorkshire branch:—"Alloy Cast Irons, Their Production, Treatment and Application," by G. W. Nicholls. At the Technical College, Bradford, at 6.30 p.m.

JANUARY 19.

Lincoln section:—"Scientific Measurement in the Foundry," by A. Scattergood. At Lincoln Technical College.

JANUARY 25.

Birmingham, Coventry and West Midlands branch:—Annual dinner and dance. At the Botanical Gardens, Edgbaston, Birmingham.

JANUARY 26.

East Midlands branch:—"Mechanisation to Maintain Foundry Production," by G. W. Nicholls. At Derby Technical College, at 6 p.m.

BOOK REVIEW

"Standard Methods of Analysis of Iron, Steel and Ferro-alloys" (Third Edition). Published by the United Steel Companies, Limited, 17, Westbourne Road, Sheffield, 10. Price 7s. 6d. net.

The fact that this book has reached its third edition is a true testimonial to its popularity. None of the physical methods, such as the absorptiometer, the spectroscope and the polarograph, is included, and the reviewer learns with interest that there is reason to believe that they are to be published in book form later. The growth in use of the physical methods will enhance the value of this book, as the fewer the determinations made, the greater the need to refer to the text-book. The text is splendidly presented, and one is pleased to see the elimination of excessive detail, such as was encountered in the older text-books. Instead there are included footnotes indicating modifications of procedure for materials differing in some way from normal.

V. C. F.

The Foundry Industry in 1945

(Continued from previous page.)

are attracting larger audiences than ever before, and the only adverse factor that we have noticed is the low percentage of youth in their midst. The Institute faces the future with but one object in view and that is to give an ever-increasing volume of technical service to its members, and through them to the great industry it serves. To the British Cast Iron and the British Non-Ferrous Metals Research Associations we offer our sincere congratulations upon the completion of 25 years of useful work for the industry. These two bodies have done much pioneer work, resulting in a clearer conception of the fundamental principles of casting technique. At Alvechurch there has followed the acquistion of truly adequate premises, a tooling up for post-war creative work. Mr. Morrough has been made manager of research and the course is now clear for accelerating the output of useful research work.

The past year has been characterised by a series of distinct industrial and social changes, resulting from the great victories after six years of hard grind. The future is far from clear, but there should be evolved during this year some sort of framework into which foundry owners can fit their endeavours with an assurance that they will co-ordinate themselves with the industrial picture of the future.

THE BRAZILIAN NATIONAL STEEL FOUNDRY at Volta Redonda is installing a new mechanised foundry to produce ingot moulds and bases, chilled-iron rolls, steel rolls, and a general line of iron, steel and non-ferrous castings. It is to cost something of the order of £460,000.

NOTES ON INSPECTION

Outline of the objects and methods employed

By R. J. HART

The East Anglian section of the London branch of the Institute of British Foundrymen devoted an evening to the study of the various systems of inspection used in the foundry industry. As a basis, three Papers were submitted from local foundries, one of which makes steel castings, a second is a large repetition malleable-iron foundry, while the third has an excellent reputation as a maker of air compressors and the like. The author of this article is chief inspector, Lake & Elliot, Limited, of Braintree. The other two articles in the symposium were "Compressor Castings," by A. F. Hammond (F.T.J., December 20, 1945) and "Inspection of Rough Castings," by R. S. Durrell, which will be published in a subsequent issue.

These notes are an attempt to illustrate the methods employed in routine inspection, both of pattern equipment and castings—mainly steel castings, although the same principles can apply to other metals. Apart from the object of inspection and general remarks, the main points are:—Inspection of patterns and samples; bulk inspection; physical testing, and delegated inspection.

Object of Inspection

(1) To ensure that castings despatched will give satisfaction to engineers, whether outside customers or the firm's own machine shop, and (2) to notify the department concerned immediately trouble is discovered, to avoid unnecessary waste of time and material. The aim of inspection should be to start at the beginning of manufacture and continue until the job is complete. Applying this to foundry work means starting with the pattern and following through the various processes until a satisfactory casting is obtained. Inspection in the past was not looked upon as a necessity to the foundry industry, but, in recent years, particularly during the war period, it has been of considerable assistance to production and should therefore not be regarded as an unproductive and somewhat despised section of a company.

Dimensional accuracy of castings, ferrous or non-ferrous, is a complete subject in itself and cannot be fully dealt with here. Some attempt has been made in the past to draw up a formula for the founder's guidance, and data of this kind are desirable to enable the industry to guarantee the accuracy necessary for modern engineering. It is possible at times to work to within $\frac{3}{64}$ in. of the given size, but in the vast majority of cases a much wider tolerance is necessary. Therefore, the words "correct" or "accurate" which may occur here must not be taken too literally.

Knowledge of Machine-shop Practice

The inspection of castings differs from that of machined articles and instruments used by engineers, such as micrometers, verniers, and so on, are rarely employed. In fact, the knowledge of machine-shop practice in the majority of castings inspectors is, unfortunately, limited. In the case of final inspection, it is debatable whether a man with this knowledge is not preferable to a man whose experience has been that of foundry work only. This is a point worth considering when engaging men for this position. Whether this would meet with the approval of foundry foremen is entirely another matter.

The surface appearance of steel castings does not usually compare with that of other metals with a lower pouring temperature. Although appearance has a high selling value, discretion must be used before rejecting a casting solely on account of its rough finish. The same consideration must be given to the finish obtained by trimmers or grinders; it is useless to expect

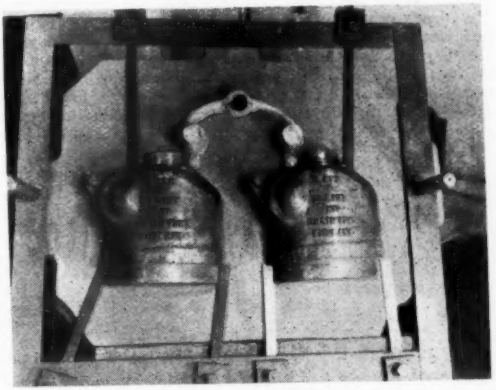


FIG. 1.—GAUGE USED FOR TESTING THE ACCURACY OF SPLIT PATTERNS.

operators to obtain a high standard of workmanship unless they have the necessary equipment and are allowed the time required to make a satisfactory job. This, of course, is much more important in the case of small iron castings, and for an inspector to demand a first-class finish from men with only second-rate or obsolete tools is asking the impossible. Therefore, maintaining a high standard of workmanship does not solely depend on an inspection department, but also on the careful supervision by individual foremen and efficient tools.

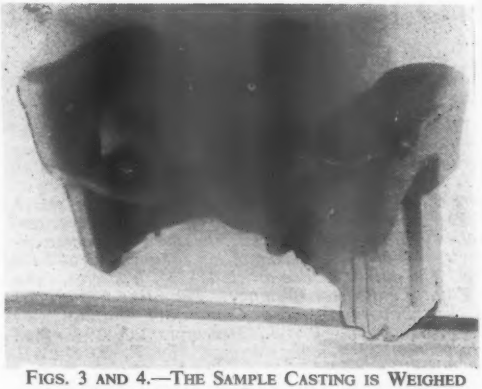
In, perhaps, the majority of firms, physical testing of material is carried out by the laboratory's staff; but, except for experimental work, the responsibility should

Notes on Inspection

be that of the inspection, as, obviously, the test-piece represents the casting, or at least should do so. It is essential that the chief inspector be directly responsible to either the directors or the general manager and not to departmental managers. This leaves him free to use his own discretion, and, providing he has tact and is willing to discuss any problems which arise, is a practicable proposition. A meeting of executives, weekly or monthly, at which the chief inspector can report and talk over difficulties, is beneficial to all concerned and should be adopted wherever possible.

Pattern Inspection

All patterns and coreboxes received either from the patternshop or from outside firms, are checked with the drawing before being issued to the foundry. This is done usually by completely lining out the job from a surface table and not merely running over it with a rule. Particular attention is paid to machining allowances, guides for cores, and also that the part number, the firm's trade-mark, and, in the majority of cases, the weekly date stamp, are clearly marked. The latter is of great assistance in tracing errors to a definite period. If it is a split pattern and mounted on either wood boards or metal plates, the two parts are carefully matched. For this purpose the simple but very reliable frame gauge shown in Fig. 1 is used. It is made of $\frac{1}{16}$-in. steel strip welded at the four corners, the fingers being ground or filed to suit the profile of the pattern at the points of contact and clamped to the frame with the aid of a block and set screw. By setting the gauge to one-half of the pattern at as many points as necessary and then reversing it for the corresponding half is much quicker and more accurate than using a straight edge or calipers.



FIGS. 3 AND 4.—THE SAMPLE CASTING IS WEIGHED WITH AND WITHOUT RUNNERS AND THE YIELD ASCERTAINED. FIG. 3 (ABOVE) SHOWS 36 PER CENT. AND FIG. 4, 79 PER CENT.

FIG. 4.

To Inspection Dept. From Foundry Office.

Please report on the following sample castings as soon as possible.

Customer..... The British Timken Ltd.

Pattern No..... 673.

Machine No..... K.

Date in Fettling Shop..... 5.7.45.

Number required by Customer..... 53 pairs.

REMARKS.

New pattern and core-boxes.

FIG. 2.—REQUISITION TO INSPECTION DEPARTMENT FOR REPORT ON NEW RUNS OF CASTINGS.

Besides dealing with new work, it is the pattern inspector's responsibility to see that all patterns and coreboxes in work are in good order, especially those for machine moulding. A list is issued weekly, giving the details of equipment required for the ensuing week, and it is the pattern inspector's duty to see that the patternshop is notified if any repairs be necessary.

Inspection of Samples

It is usual for the pattern inspector to be present during the coring-up of the sample. This is more satisfactory to all concerned, as some moulders are apt to use a file and do a little "touching up" before trying

the core in the mould. When the mould is cast the progress deparument issue a card to the inspection, giving particulars of the customer's name, number "off" and the reason for making the sample (see Fig. 2). This system is much better than a verbal message, which can be misunderstood or forgotten.

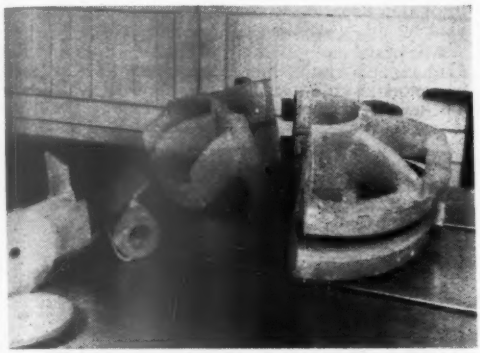


FIG. 5—TRACK TENSIONER CASTING AFTER SECTIONING FOR INSPECTION.

Also, the sample's order of priority is given and the inspection deals with it accordingly. The number "off" is important, as it decides whether the sample shall be machined and sectioned. The sample is visually inspected as soon as it leaves the sand-blast.

Here, there is a man who has served some time both in the foundry and coreshop and is therefore familiar with the practice of both. Should he consider that some improvement should be made, suggestions are passed to the foreman concerned. This same inspector is responsible for weighing the sample, complete with runners and feeders, to ascertain the percentage of casting to metal poured. Figs. 3 and 4 give the difference in weight of finished castings to their "as cast" weight, the figures shown being pounds. This information is necessary for costing purposes.

Having been completely fettled, the sample is marked off. For this job there is a room at one end of the fettling shop fitted with a large surface table, capable of taking practically every size of casting made. Another inspector here has had experience both of machining and general engineering, and is therefore conversant with the "snags" which are likely to occur from this angle. It is customary to have the jigging positions or datum lines marked on the drawings, and it is from these positions, of course, that the lining out is commenced.

Sample Machined and Sectioned

The marking-off completed, if no major mistake is found, the sample is then machined and sectioned. In the case of diameters, it is usual to machine both internal and external dimensions to drawing size first, and, after inspection, if satisfactory, to remove further metal. Often trouble is discovered just below the finished size. This destruction test, of course, is only given where the number of castings ordered warrants the expense, or where the size and weight are such that it is still an economic proposition. Fig. 5 gives a view of two machined and sectioned steel castings, one being a track tensioner wheel as used on a cruiser tank and in 35 to 40 tons tensile material, the other a small bracket with a tensile strength of 28 tons, one of the many varying types for the heavy vehicle industry. Wherever possible, of course, a sample is sent to the customer for a fully machined report, especially when the castings are to be submitted to a pressure test. In the majority of cases it is found that he is willing to co-operate, as obviously it is far better to do this than to have even a small batch of faulty castings.

The result of complete inspection is entered on an inspection report form and sent to the progress department (see Fig. 6). The rough weight is shown, but the finished weight is omitted. The inspection report is completed before heat-treatment and the final weight is obtained from the despatch department. The job, if satisfactory, is now ready for production. If unsatis-

INSPECTION REPORT. **To Foundry Office.**

Customer	Ministry of Supply			*Date*	20. 7. 45.
Part Number	29414 T. (Experimental.)				
If O.K.	NO.				
Reason for Rejection	Unsound in arm. Cracked under chills. Incorrect specification.				
Further Sample Required	YES.				
Rough Weight	*Cwts.* 3	*Qrs.* 2	*Lbs.* 22		
Fettled Weight	*Cwts.*	*Qrs.*	*Lbs.*	*Chief Inspector.*	

FIG. 6.—REPORT FORM USED FOR REJECTED CASTINGS.

Notes on Inspection

factory, a further sample must be made after the errors are corrected.

Bulk Inspection

In the first place the "cast" sheet is checked. This sheet gives particulars of the number of castings made from each heat of metal, together with the specifications. Rejects can then be made, if necessary, before fettling is commenced. As in the case of samples, all castings are visually inspected after sand-blasting. Errors, such as misplaced cores, cracks, faint runs and so on, can therefore be rejected at this stage. The work here is carried out by the inspector who is responsible for the initial sample; he also has a roving commission throughout the fettling shop to watch castings in their various stages and to report persistent errors. Any rectification by welding can only be done after consulting an inspector. A destruction test of not less than 1 per cent. is given to large orders to ensure that the quality of the sample is maintained. After heat-treatment and subsequent sand-blasting all castings are finally inspected. The men here are equipped with gauges, templates and jigs, which are made in the inspection department roughly to coincide with those used by the machinist.

When making gauges it is customary to have the finished and casting lines clearly marked to enable inspectors to use their discretion as to whether the job will clean up. Satisfactory castings are then passed into the stores ready for despatch. Fig. 7 shows a jig used for a rear-axle casing, the location points being identical with those used by the machinist for

FIG. 7.—JIG USED FOR THE INSPECTION OF A REAR AXLE CASING.

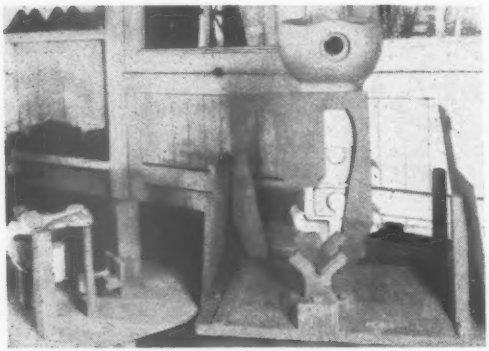


FIG. 8.—SHOWS TYPICAL GAUGES USED BY THE INSPECTION DEPARTMENT.

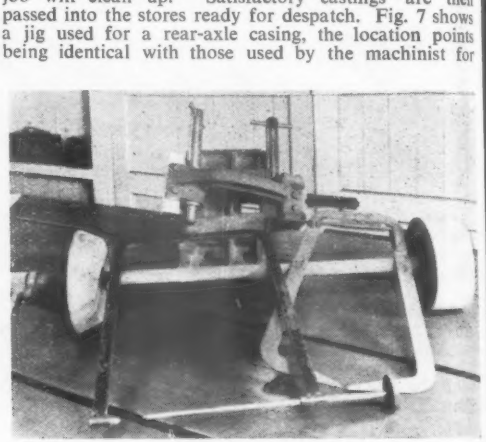


FIG. 9.—CALIPERS, A MARKING-OFF TOOL AND A SPECIAL GAUGE.

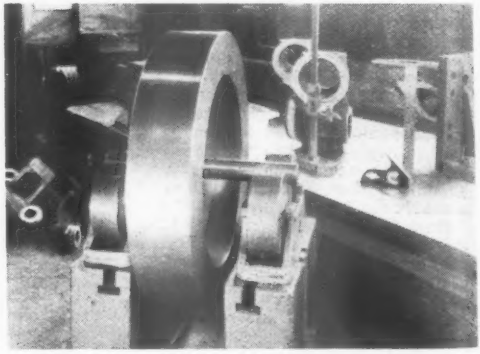


FIG. 10.—A BALANCING DEVICE FOR FLYWHEELS.

the first operation. In Fig. 8 three simple gauges are illustrated; the stub axle in the rear has a three-point initial location in the hemispherical bore. The casting is gauged from these points to the four outside bosses. In the foreground is the jig used for the main fork castings of the universal carrier; some thousands of castings have been checked with this, with very good results. On the left is a gauge for checking the centres of various small brackets. Simple calipers and a tool for marking off positions from a cored bore are illustrated in Fig. 9. The jig at the back checks the connecting-pin centres and hinge bosses of steel track plates. Fig. 10 shows the final operation of a finished machined cast-iron flywheel with a static balance tolerance of 1 oz.

Finally, a scrap sheet is compiled each day giving the number of castings rejected and the reasons for rejection. Copies of this sheet are sent to the progress department, foundry superintendent, and one copy retained for the inspection department. Each week a return is made to the directors showing the total rejections for the week and the number of faulty castings returned from outside customers, with necessary remarks. The scrap sheets (Figs. 11 and 12) are self-explanatory; the code letter seen in the steel sheet denotes the stage at which the castings are rejected, *i.e.*, "B"—sand-blast, "W"—welders, etc.

Physical Testing

A hardness test is applied only to certain castings; these are usually of alloy steel or high-duty cast iron. In the case of iron brake drums, each one is Brinelled and a record kept of the results. The impression is made on the outside surface of the bolting face as near to the internal diameter as practicable, a small area being first cleaned with a hand grinding wheel. This test, of course, is for general machinability only, and, although it usually fails to detect hard spots, may provide data for correlation with other properties. If the Brinell hardness number is on the top limit of the specification, a file test is applied, which, although somewhat crude, is a further check. Fig. 13 is a graph showing the results obtained from brake drums and the B.H.N. range.

Steel test-blocks (Fig. 14) representing each cast are received from the foundry bearing the particular heat number, and the inspection sees that they have the correct heat-treatment, together with the castings they represented. After being removed from the annealing furnaces, the blocks are cut into three bars, namely, tensile, bend and impact. Two lathes are used in machining the bars, one for roughing-out and the other for finishing. If a test-piece fails to meet the required specification it does not necessarily mean that the castings are rejected. If the cause of the failure

LAKE & ELLIOT, LTD.

Steel Castings Inspection Dated 18. 8. 45.

	Pattern No.	No. Off	Remarks
Saunders.	5 B 4084.	9	Drum (E).
	5 B 4071.	1	Blom.(E).
L. & E.	4301.	5	2 Spongy. 2 Dirty.(S). 1 Core out of position.(E)
Prinstans.	X 5376.	1	Not out.(E)
	5/228.	1	Drum. (S)
Stone.	ED 1/13.	7	Core out of position.(I)
E.Lake.	707/1.	2	Lapped. (S)
Crosby.	6259/1.	1	Scabbed.(S).
Thornycroft.	133448.	2	Core out of position. 1 Blom.(S).
	133416.	1	Lapped. (S).
	8418.	4	Slag.(E)
Coles.	7139.	1	Dirty. (T)
Allen.	G 5100.	2	" (W)
	M.3178.	11	10 Strained.1 Core out of position.(S)
	M.203.	1	Slag.(S)
	X 395.	3	Swollen.(E)
Brunber.	C.5.	2	1 Lapped. (S) 1 Slag.(E)
	MW.963.	1	Blom.(S).
Walker.	9C 61 &.	1	Core out of position.(T)
Rolls Royce.	RC 1885.	1	Blom.(S)
Dennis.	92818.	1	Slag. (E)
Acrow.	4A X 627.	1	Lapped.(S)
H.O.S.	29548 T.	5	4 Swollen.(E). 1 Mould Broken. (S)
A.E.C.	W 11442.	2	Slag.(E).
	W 10124.	1	"
	J 10119.	1	Cracked. (W)
Foxboro.	D 304.	1	Slag. (E)

Chief Inspector

FIG. 11.—DAILY SCRAP RECORD.

C.4101. LAKE & ELLIOT, Ltd.

IRON CASTINGS INSPECTION. (NILAMITE.) Cast Aug.18th.1945. Date Aug. 20th.1945.

	Pattern No.	Accepted	Core Joint.	Dirty Surfaces	Dirty.	Scabbed	Swollen Mould out of pos.	Shrinkage Cracks	Blown	Burnt Sand	Chipped	Cracked	M/Cks.	Core out of position	Broken
Hoffmann.	BH 5599.	68			14							16			30
	BH 5600.	68			7		6				1				14
Platters.	1326.	39	3								1				4
Air Control.	1155.	20													
Tanner.	CA/P482/2.	10													
Avery.	B 2196.	3								1					1
	B 2437.	2													
	B 2442.	1													
Anthony Hoists.	17 B 116.	3			4				1					1	6
Allen.	M 6002.	1													
Perkins.	097503.	2													
Levey.	10002 Mod.	1													1
Guy Motors.	FD 1733.	8			1										1
Jaguar Cars.	14/332.	6									6				6
Rubber.	P.56196 C.	280			2				2	38			2		30
Gunner Cars.	7555BR.	32					1		4				1		6
Daimler.	138704.	52					1	3	19		4		1		28
	P 127.				1										5
	2686.				2										6

Chief Inspector

FIG. 12.—ANALYSIS OF SCRAP RECORD.

Notes on Inspection

is due to an obvious flaw and no further test-bar is available, a chemical analysis is taken of the actual castings, the heat-treatment checked, and a decision made from these results.

In some cases it is necessary to record not only the yield point of the material but also the proof stress. This can only be obtained by the use of a precision instrument such as an extensometer, the deviation from the line of proportionality being expressed as a percentage of the gauge length. The percentages usually employed are from 0.1 to 0.5 per cent. Several methods are used to obtain the proof stress, but the most accurate and probably the quickest way is to plot a stress strain diagram. Fig. 15 is a stress strain diagram giving results of two test-bars, one taken from an actual casting, the other from a loose test-block. The material is manganese-molybdenum quenched and tempered steel with a 0.2 per cent. proof stress of 30 tons per sq. in. minimum.

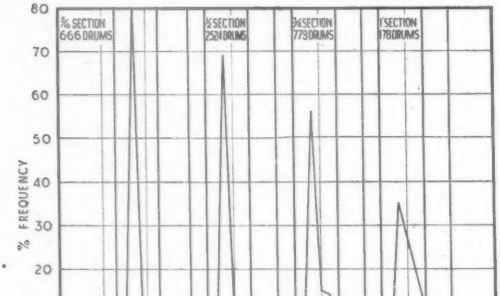


FIG. 13.—SHOWS THE HARDNESS RANGE OF BRAKE DRUM CASTINGS.

FIG. 14.—TYPE OF TEST-BLOCK USED.

Delegated Inspection

Inspection delegated by the various ministries is only granted to companies who can satisfy them that they possess an inspection organisation capable of supervising their contracts, either direct or indirect, and an agreement to this effect must be drawn up. The chief inspector is solely responsible to an official controlling the particular department. This arrangement serves a twofold purpose: (1) it enables the chief inspector to release material which would otherwise be held up pending the visit of a Government officer; and (2) it obviates the necessity of resident Government officials, thereby saving public money.

The former is a definite time saver, but is an added responsibility to the inspection department and entails a considerable amount of clerical work. Each consignment of castings despatched must be covered by the relevant test certificates, release notes and inspection notes—usually six copies of each. Official procedure in the distribution of these forms may seem

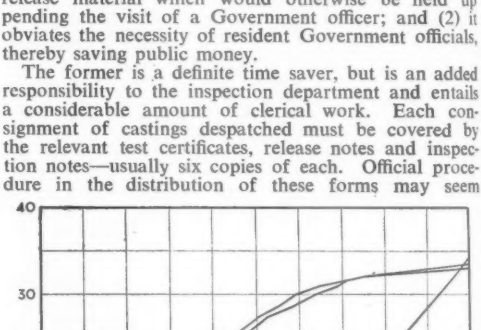


FIG. 15.—PROOF STRESS GRAPH OF MANGANESE-MOLYBDENUM STEEL.

unnecessarily complicated, but it would be unwise to attempt to short-circuit them in any way, as this would only lead to confusion and perhaps the withholding of payments due. Complete records of castings, together with their physical and chemical properties, must be

(*Continued on page* 21, *column* 2.)

SAND SUPPLY TO MOULDING MACHINES FROM OVERHEAD HOPPERS*

By N. C. BLYTHE

In foundries, overhead hoppers are usually arranged in line over moulding machines so that the sand can be dropped directly into the moulding boxes and they are most frequently used for filling relatively small green-sand moulds. The service which should be expected of them is that a controllable quantity of sand can be obtained by the operator *on demand* at almost any frequency throughout the working day. As an example, it is not uncommon to make one half-mould every 30 secs. over an extended period so that demands for sand from the hopper will be made with that frequency, and it would be unsatisfactory if the operator could not get sand just when it was required or in any other way failed to fill a small mould within about 2 secs.

A search was begun a long time ago to discover a design of hopper which would satisfy this service specification, using quite a normal green sand derived from Bromsgrove natural red sand and having a moisture content of 5½ per cent., a green compression of 11 lbs. per sq. in. and a permeability of 25. It was soon obvious that there were very many hoppers in existence which failed to come up to the required standard. It was observed, for instance, that operators were often unable to obtain sand on demand and even resorted to hammering the outside of the hopper in the hope that some sand would become dislodged. For this purpose a heavy mallet or an iron bar was kept ready at hand and the marks and indentations on the hopper were a reliable indication of how well they worked.

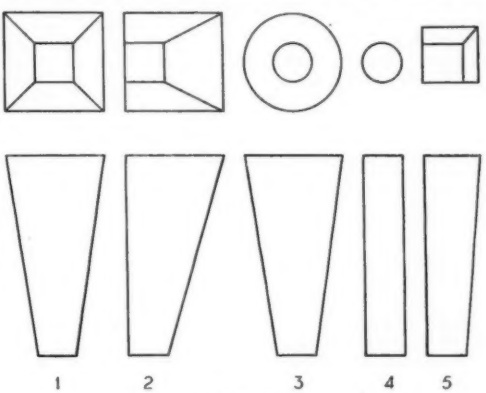
Design of Hoppers

It is known that this common failing is not due to the design of the operating mouth and indeed the type which has become very common—that which is known as the "cut-off" type—is very satisfactory, and is usually a feature of most mechanised plants. The fault undoubtedly lies in the practice of making the hoppers taper too generously outwards above the mouth for the purpose of obtaining a wide top and in the hope of getting greater capacity.

Every foundryman knows of the difficulty in making sand slide down an inclined chute and a hopper which has substantially tapered sides will not empty itself by gravity. Observations on these hoppers will show that the moving sand, and the effective capacity, are represented by a volume of sand in the form of a column directly above the hopper opening and that a considerable proportion of the sand in the hopper is static. This is generally true of the shapes of hoppers in Figs. 1, 2 and 3, all of which are of common design.

Numerous experiments were made in an endeavour to overcome this, such as painting the inside of the hopper with glossy paint, lining it with glass and vitreous-enamelled sheets, and vibrating it. All of these failed to produce any marked improvement on hoppers with sloping sides. This led to the idea that a hopper should have vertical sides, and since sand appeared to stick most readily in square corners, that there would be some further advantage if it was circular in section.

There was an immediate objection, however. The dimension of a hopper mouth is usually restricted to a size which is less than the mould which has to be filled in order to avoid excessive spillage, and if the sides are vertical, the top of the hopper becomes equally small. In this case a 14 in. dimension at the mouth was selected to fill moulds 18 in. × 12 in. and the same 14 in. dimension at the top of the hopper would have made it difficult to fill it mechanically. Nevertheless, in order to test the theory, a circular parallel hopper as shown in Fig. 4, but 20 in. in dia., was constructed and put into regular service. The results showed that the parallel sides were better than the tapered sides, but it was not possible to detect any marked improvement resulting from the circular section. The most serious disadvantage was that there was excessive spillage because the mouth was larger than the moulds in this particular case and this offset any other advantage. The ultimate compromise, therefore, was a hopper 14 in. square at the bottom and 20 in. square at the top, but having two vertical sides and two slightly tapered sides. (Fig. 5.)



FIGS. 1-5.

It was known that if one of these hoppers was filled and immediately afterwards sand was drawn from it in the normal manner, it could be emptied completely.

*A Paper read before the Birmingham, Coventry and West Midlands branch of the Institute of British Foundrymen, Mr. A. J. Shore presiding.

Sand Supply to Moulding Machines

It was found later that, if it was allowed to stand for two days without being operated, then only about 92 per cent. of the sand could be withdrawn, and if it was operated regularly during these two days, the effective capacity was reduced still further to 60 per cent.

A Controlling Factor

All this experience has led to the conclusion that the size of the hopper opening or mouth is a controlling factor and that in every hopper it will be found that, sooner or later, the effective capacity is no more than that of a column of sand which is approximately vertically above the hopper opening, having a cross-sectional area relative to the hopper opening, and a volume which is less than the nominal capacity of the hopper. The important point is that, if this loss of capacity occurs in a hopper having nearly vertical sides like the one described, how much worse will it be in one which is tapered more generously?

Furthermore, as many people know, it does not stop at that, because this loss of capacity is progressive. The sand continues to build up on the sides, reducing the cross-sectional area of the column until eventually the hopper becomes choked.

For these reasons, therefore, it seems to be unpracticable to obtain any substantial storage of sand in machine hoppers and such storage as is possible is more a function of their length than of their girth. The hoppers which are described here are 9 ft. long, and the average effective capacity is only sufficient to maintain a fast moulding machine at work for about 4 min., and there is nothing to lead one to believe that this storage time value could be any more with hoppers of bulkier design. As a matter of fact, where real storage of sand is required, such as in the main storage tank of the plant, it has been found that this can be obtained most effectively by making the tank wider at the bottom than at the top.

Consequently, if a constant supply of sand is to be available to the machine operator on demand, then it is imperative that the sand which is withdrawn from the hopper is replaced quickly—immediately if possible—but certainly within the number of minutes of the storage time value.

Sand Supply to Hoppers

This supply of sand to a line of hoppers is normally accomplished in one of two ways, in the choice of which there is a considerable division of opinion. There is the flat rubber belt conveyor from which the sand is ploughed sideways into the hoppers arranged alongside the belt—and there is the scraper or push-plate conveyor in which the sand is pushed along a trough and through openings in the trough into the hoppers fastened underneath it. The constructional details of these two conveyors are probably sufficiently well known to make any further description unnecessary. It is rather a question of choice. Experience with both types has led to an undoubted preference for the push-plate conveyor.

The push-plate conveyor will immediately, and with certainty, replace the sand which has been taken from any hopper so that it is always kept filled. Moreover, it will do so automatically—that is, without any attention from a man working overhead—and without spillage, because the hoppers are closely fastened to, and indeed are part of, the conveyor trough.

When a belt conveyor is used, manual operation of the plough is more common than not, and is often accomplished by a man working overhead. Failing this, spillage occurs, and nothing is more annoying to operators than a stream of sand falling on them! But that is a relatively minor matter. The basic consideration is that, since it is shown that for continuous working the hoppers must be replenished at very frequent intervals, this can be accomplished entirely satisfactorily by a push-plate conveyor, but not by a belt conveyor. The difference in performance in favour of the push-plate conveyor will become more apparent as the number of hoppers is increased or if they are short and of smaller capacity.

There are various devices which have been designed to eliminate this criticism of belt conveyor distribution. These can be regarded as attempts to make sand distribution by belt conveyor nearly as good as by push-plate conveyor!

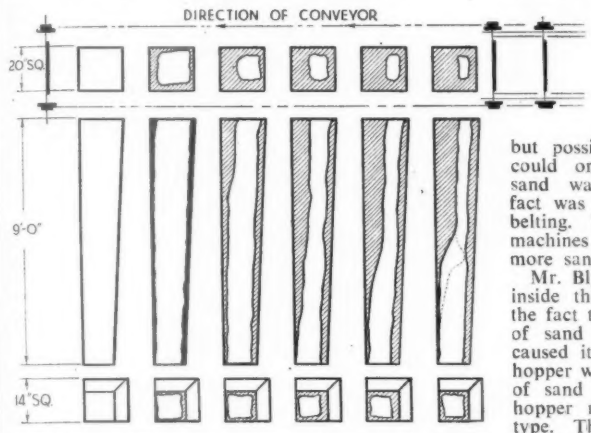
It may appear, from what has been said, that the perfect overhead hopper does not yet exist. The combination which has been sought, however, is a type of hopper which will provide a machine operator with sand every time he wants it and with the same certainty as drawing water from a tap, and a distribution conveyor which will take care of the hopper's failings regarding capacity and automatically ensure that a supply of sand is always available in the hopper.

Working Results

Almost the whole text of this Paper has been summarised in Fig. 6, which is a record of the performance of one of 20 similar hoppers under actual conditions. It also shows the regularity with which a sand supply is maintained by a push-plate conveyor. The progressive daily reduction in the effective capacity of the hoppers is shown diagrammatically and by the figures of effective capacity and storage time value. In spite of this, however, the hopper continued to operate perfectly for nearly a whole week. On the fifth day the capacity had diminished to such an extent that the hopper choked twice (as shown by dotted line on diagram) and had to be cleared by poking—an operation which takes only a minute or so. Nevertheless, during the full working week of 40 hrs. the hopper was operated 4,138 times to draw 68 tons of sand for 2,069 complete moulds, *and failed only twice*. Moreover, although the storage time value had fallen to less than 2½ min., the push-plate conveyor maintained a supply of sand *without any failures whatsoever*.

This record is quite typical of regular experience over several years. In order to maintain it, it is the invariable practice to empty the hoppers completely

each week and allow them to remain empty and open over the week-end; that is all. So far as is known, comparable figures of performance for similar or



Days.	—	M.	Tu.	W.	Th.	F.	Total
Duration of test (hours)	—	8	8	8	8	8	40
Sand used (cwt.)	—	300	296	284	274	216	1,370
Complete moulds made	—	472	442	424	409	322	2,069
Hopper operations	—	944	884	848	818	644	4,138
Number of failures	—	0	0	0	0	2	2
Effective capacity (cwt.)	10½	8	5¾	4¾	3¼	—	—
Storage time value (mins.)....	8	6	4¼	3½	2½	—	—

FIG. 6.

alternative types of equipment have not been published previously or are otherwise available, but by any standard two failures out of over 4,000 operations cannot be regarded as being unsatisfactory.

Vote of Thanks

On the proposition of Mr. J. G. Pearce, seconded by Mr. Hill, a vote of thanks was accorded Mr. Blythe for his Paper. The Author subsequently replied to numerous questions raised by members. While admitting there was some wear on the blades of a push-plate conveyor, he did not regard this as being at all serious, replacements only being found necessary every two or three years. The trough did not get worn because of the skin of sand thereon. While he thought the cylindrical hopper was better, one 20 in. in dia. was too big to fill a mould 17½ in. by 12 in. owing to spillage. The alternative was to make the bottom of the hopper higher and suspend under it a tun-dish. If the sand dropped too far, the moulds tended to get packed in the centre and loose on the edges. He did not agree that it was impossible to keep all the hoppers filled with a push-blade conveyor, but possible with a conveyor belt. Every hopper could only be supplied all the time if sufficient sand was coming along the conveyor, and that fact was true irrespective of the type of conveyor belting. No conveyor system would supply all the machines all the time unless it was passing slightly more sand than was being used.

Mr. Blythe did not think the building-up of sand inside the hopper was due to condensation, but to the fact that a slight skin was formed by the particles of sand being driven across the back edge which caused it to pile up there. No matter what shaped hopper was used, its effective capacity was the column of sand above the mouth. The "cut-off" type of hopper mouth was more efficient than the "fish" type. The height of the push-blade conveyor was determined by other parts of the equipment, which must be a reasonable height above the moulder.

ALLOYS FOR ZINC BASE DIE-CASTING

Mr. John R. Govett, in his statement as chairman at the annual meeting of the Imperial Smelting Corporation, Limited, said that the production of both zinc and sulphuric acid was intensified during the war. Zinc furnaces were extended at Avonmouth, idle furnaces at Seaton Carew and Bloxwich were restarted, and a peak production of 75,650 tons of zinc was achieved in the year ending June 30, 1942. Subsequent periods showed outputs not far short of this figure. New or enlarged plants for the production of refined metal, alloys, and zinc dust were constructed. These comprised the enlargement of the refluxer plant for producing high purity zinc from 30 to 40 tons per day refined metal capacity, new alloying units at both Avonmouth and Bloxwich, and the new air blown zinc dust plant erected and operated at Avonmouth on behalf of the Government. The most striking advance was in the production of alloys for zinc base die-casting, which in the year ending June 30, 1943, reached the peak total of 53,736 tons. This compared with an annual output of 5,000 to 6,000 tons prior to the outbreak of war. The production of cadmium metal was largely increased. Mr. Govett said that during the periods when Britain was being subjected to enemy air raids, an extensive, though relatively unimportant, amount of damage was done to the plants of their smelting group. This was largely a matter of good fortune, since an aggregate of 130 high explosive bombs, in addition to many hundreds of incendiary bombs, fell on the site of the Avonmouth works alone.

CONTROL OF LABOUR

RECENT RELAXATIONS

Relaxations of the control of labour decided upon by the Government took effect on December 20. They include the exemption in general of all men over military age (that is, men of 31 and over) and all women, from the Control of Engagement Order and also from direction except in a few industries of high priority. Existing controls will continue in the building and civil engineering industries. No change is made in the provisions of the Essential Work Orders, but there is to be an increasing liberation of industries and firms from the operation of the Orders following a review by Government departments. The policy of the Ministry of Labour is to reduce the list of firms covered by these Orders as quickly as possible, and to make the list as short as possible.

The following are extracts from a statement by the Minister of Labour outlining the decisions.

The Government have decided that for the time being the Essential Work Orders must in general be retained, both for men and women, for those industries and services in which it is essential in the national interest to maintain the existing labour force. The effect of this decision will be to withdraw a number of less important industries from the scope of the Orders in the near future.

The various industries at present covered by Essential Work Orders will be reviewed and, where it is decided that it is no longer necessary from the point of view of production and man-power to continue this control, the organisations representing both sides of the industry will be informed that the industry will be withdrawn from the scope of the Orders. It is intended to give three months' notice of withdrawal.

Direction of Labour

As to the control of engagement of and the direction of labour, the principle which the Government have decided to follow is to limit control, subject to certain exceptions, to those classes of person who for the time being are being called up for military service.

In accordance with this decision, directions will in future not be given to women of any age, with the exception of nurses, and in exceptional cases for the purpose of making effective the Essential Work and similar Orders. The system of registering women under the Registration for Employment Order as they reach the age of 18 is to be discontinued forthwith.

Subject to certain exceptions, the use of directions in respect of men will be limited to those up to and including the age of 30, which is the present maximum age of call up to the Armed Forces. When the age of call up is lowered, the age up to which directions are used will be correspondingly lowered. This power of direction will be further limited by using it only to meet the special needs of a few industries and services which are identified from time to time as having high priority.

Similarly, the Control of Engagement Order, which requires that labour should be engaged only through a local office of the Ministry of Labour or other approved agency, will, subject to one or two exceptions, in future apply only to men up to and including the age of 30 and not to women of any age. In addition, the present ban on employers in seeking to engage workers by Press advertisement or otherwise will be removed, though employers must still make the engagement through a local office of the Ministry of Labour or approved agency in the case of persons still subject to the Control of Engagement Order. This general age limit of 30 will be lowered when the call up age is lowered.

Exceptions

Among the exceptions are the building and civil engineering industries, which it is considered present a special problem, because it will be essential for some time to come that the highest possible proportion of their labour force should be employed on the housing programme. The Government have therefore decided that the power of direction must be retained beyond the age of 30 in respect of men in these industries up to the age of 50. Control of engagement for men up to 50 within these industries will also be retained.

Another exception is agriculture. No man up to and including the age of 50 whose normal employment is in agriculture may take a job outside agriculture except through an Employment Exchange, and no employer may engage such a man for work other than agriculture except through an Employment Exchange.

Men and women released from the Services in Class B have been required to take employment in the occupation and the industry for which they were released. Up to now most of them have been directed under Defence Regulations to a particular job. The general change in labour controls will apply to them as it does to civilians and they will not be directed to their civilian work except in circumstances in which a civilian would receive directions. Men and women who are nominated by their employers for release in Class B will be required to take the particular job in respect of which their release has been granted. Those who do not comply with the conditions on which their release was granted will be liable for recall to the Forces.

It is the Government's intention that the limited controls which will remain in force should be strictly enforced, if necessary by the institution of proceedings against offenders—whether they be employers or workers. At the same time, it is stated, they will be carefully administered so as to avoid individual hardship. Individual workers covered by the Essential Work Orders may, as at present, apply at any time for permission to leave on personal as well as industrial grounds and there is a right of appeal if permission is refused by the National Service Officers. Similarly employers may seek permission to discharge an individual worker.

DURING THE WAR, the International Nickel Company of Canada delivered to the United Nations no less than 670,000 tons of nickel. This was 50 per cent. higher than normal peacetime production, when the peak figure was 107,142 tons in 1937.

BRITISH PIG-IRON PRODUCTION DURING THE WAR

A BRIEF STATISTICAL RECORD

With the termination of the war, the British Iron and Steel Federation have issued a statistical record covering the years 1939-1944, entitled "Statistics of the Iron and Steel Industry of the United Kingdom." The section dealing with pig-iron and ferro-alloy production in blast furnaces, contains some 16 tables giving comprehensive details relating to new blast furnaces, and furnaces dismantled, numbers of furnaces in blast and output per furnace; materials consumed per ton of pig-iron, and other information. The accompanying tables, which are abbreviations of the originals, give a general indication of the blast-furnace industry's activities during the war years.

TABLE I.—*Furnaces in Existence at End of Years* 1939-1944.

District.	1939.	1940.	1941.	1942.	1943.	1944.
Derby, Leics, Notts, Northants and Essex ..	34	34	34	35	35	35
Lancs (other than N.W. Coast), Denbigh, Flint and Cheshire	8	8	8	8	8	8
Lincolnshire	19	19	19	19	19	19
North-East Coast ..	48	47	47	46	47	45
Scotland	21	22	22	22	22	22
Staffs, Salop, Worcs, and Warwickshire ..	21	21	19	19	19	17
South Wales and Monmouth	9	9	10	10	10	10
Sheffield	4	4	4	4	2	2
North-West Coast ..	18	18	18	17	17	17
Grand Total ..	182	182	181	180	179	175

Blast furnaces built during the war numbered seven, three of which (Appleby-Frodingham 2, Guest, Keen, Baldwins, Cardiff, 1) were erected in 1939. One furnace was built in each of the succeeding four years—Colvilles, Limited, 1940; Guest, Keen (Port Talbot), 1941; Wellingboro' Iron, 1942; Consett Iron, 1943. No furnaces were built in 1944.

TABLE II.—*Average Number of Furnaces in Blast in he United Kingdom*, 1939-1944.

Year.	Average No. of furnaces in blast.					Output per furnace per annum.
	Hematite.	Basic.	Foundry, forge, direct castings.	Blast-furnace ferro-alloys.	Total.	
	No.	No.	No.	No.	No.	000's tons.
1939 ..	19.66	56.42	28.92	3.34	108.34	73.7
1940 ..	20.00	71.15	29.33	4.08	124.56	65.9
1941 ..	12.41	76.42	29.67	3.25	121.75	60.7
1942 ..	13.91	74.91	26.00	4.00	118.82	64.0
1943 ..	13.17	67.59	23.66	3.08	107.50	66.9
1944 ..	13.34	64.17	18.93	4.42	100.86	66.8

Ten furnaces were dismantled in 1939, as follows: Dorman, Long, 1; Colvilles, 1; William Dixon, 6; Goldendale Iron, 1; New Westbury Iron, 1. Consett dismantled a furnace in 1940; Round Oak 2, in 1941: Linthorpe Dinsdale 1 and Workington Iron 1, in 1942; Newton, Chambers 1 and Park Gate Iron 1, in 1943; Consett 1, Skinningrove Iron 1, Wellingsworth Iron 2, in 1944. Thus, from 1939 to 1944 inclusive, 21 furnaces were dismantled. Table I gives the number of furnaces in existence at the end of each year, 1939 to 1944.

The average number of furnaces in blast in all dis-

TABLE III.—*Production of Pig-iron and Blast-furnace Ferro-alloys in the United Kingdom*, 1939-1944. (*Thousands of tons.*)

Year.	Hematite.	Basic.	Foundry.*	Forge.	Direct castings.	Blast-furnace ferro-alloys.	Total.
1939.. ..	1,396.1	5,108.1	1,203.5	167.3	3.0	101.8	7,979.8
1940.. ..	1,428.2	5,452.5	1,062.1	119.0	2.3	140.5	8,204.6
1941.. ..	905.9	5,182.3	1,081.8	101.1	1.0	120.4	7,392.5
1942.. ..	963.7	5,553.3	963.4	69.2	1.1	174.9	7,725.6
1943.. ..	927.2	5,070.0	1,025.3	40.4	0.4	123.6	7,186.9
1944.. ..	1,009.2	4,791.6	740.3	35.4	0.5	159.5	6,736.5

* Includes "Other Qualities" of pig-iron (*i.e.*, special foundry iron).

TABLE IV.—*Materials Consumed per Ton of Pig-iron and Blast-furnace Ferro-alloys Produced*, 1939-1944.

Year.	Materials consumed.							Coke consumed.†
	Iron ore and manganese ore.‡		Sinter.	Limestone.	Scrap.	Other materials.*	Total.	
	Home.	Imported.						
	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.
1939.. ..	28.93	13.14	4.81	5.05	0.96	2.15	55.04	21.82
1940.. ..	33.45	10.03	5.91	6.35	0.93	2.38	59.05	23.46
1941.. ..	41.76	4.48	6.48	6.81	1.28	2.10	62.91	24.74
1942.. ..	41.68	4.32	6.28	6.88	1.68	2.00	62.84	24.73
1943.. ..	40.92	3.90	6.54	6.66	1.99	1.88	61.89	24.40
1944.. ..	37.66	6.06	6.74	6.50	1.80	2.18	60.94	24.40

‡ Raw and calcined, as charged. * Purple ore, cinder and scale. † 66 tons of coke = 100 tons of coal.

TABLE V.—*Imports of Iron Ore (excluding Manganiferous and Chrome Iron Ore and Iron Pyrites), by Country of Consignment*, 1939-1944.

Country of consignment	1939	1940	1941	1942	1943	1944*
		(In thousands of tons)				
Iron Ore						
Sweden ..	1,147.4	488.8	—	—	—	—
Norway ..	359.8	136.1	3.6	—	—	—
Netherlands	61.2	11.1	—	—	—	—
France ..	514.1	490.4	—	—	—	—
Algeria ..	1,502.7	1,162.9	1.0	—	305.6	636.2
Tunis ..	491.4	290.7	8.3	—	—	—
Spain ..	567.4	655.8	264.6	238.1	265.4	205.9
Spanish ports N. Africa ..	124.3	44.4	384.9	443.8	541.7	572.4
Brazil ..	31.3	107.9	167.3	222.8	261.9	239.4
Other foreign countries ..	60.4	4.4			10.6	7.4
Total, foreign countries ..	4,860.0	3,392.5	829.7	904.7	1,385.2	1,661.3
Sierra Leone	190.1	506.6	920.0	666.5	502.1	482.6
Newfoundland and Labrador ..	189.0	591.1	244.5	239.9	2.6	19.5
Other British countries ..	0.8	58.5	289.1	110.5	4.5	3.9
Total, British countries ..	379.9	1,156.2	1,453.6	1,016.9	509.2	506.0
Grand Total: Tons ..	5,239.9	4,548.7	2,283.3	1,921.6	1,894.4	2,167.3
Value, £000	6,912.4	9,619.1	9,069.2	7,601.7	7,889.9	9,118.1
Manganese Ore						
Tons ..	325.0	247.1	314.2	421.2	444.6	316.3
Value, £000	1,068.7	1,171.6	1,855.3	2,696.0	2,868.3	1,920.1

* Subject to amendment.

Africa, and a growing tonnage of ore from Spanish ports in that region, rising from 44,400 tons in 1940 to 384,900 tons in 1941, thereafter increasing steadily until imports reached 572,400 tons in 1944, comparing with only 124,300 tons in 1939. British countries, however, supplied 1,156,200 tons of ore in 1940 and 1,453,600 tons in 1941. Subsequently shipments from Sierra Leone gradually fell, and in 1943 those from Newfoundland almost disappeared. The net result was that, while in 1941 imports of ore from foreign countries reached only 829,700 tons and those from British countries 1,453,600 tons, by 1944 the order was reversed, foreign ore imports reaching 1,661,300 tons and ores from British countries falling to 506,000 tons. It is interesting to note that the average value of iron-ore shipments to this country in 1943 and 1944 was over £4 per ton, compared with, roughly, 26s. per ton in 1939.

Particulars of the materials consumed in the production of pig-iron and blast-furnace ferro-alloys during the war years compared with 1939 are given in Table VI. It may be said in explanation that the average quantities of home and (imported) ores used in the production of 1 ton of sinter in the years 1939-44 were as follow:—1939, 19.93 cwts. (1.98); 1940, 16.56 cwts. (2.02); 1941, 17.65 cwts. (1.98); 1942, 17.94 cwts. (2.17); 1943, 17.94 cwts. (2.51); 1944, 17.14 cwts. (3.04). Further coke consumption included the following quantities of coal consumed in the raw state, mainly used in the production of foundry and forge pig-iron:—1939, 36,300 tons; 1940, 35,500 tons; 1941, 31,900 tons; 1942, 23,800 tons; 1943, 35,800 tons; 1944, 39,200 tons.

TABLE VI.—*Materials Consumed in the Production of Pig-iron and Blast-furnace Ferro-alloys*, 1939-1944.

Year.	Total production.	Materials consumed.						Coke consumed.	Total coal equivalent of coke consumption†
		Iron ore and manganese ore.*		Sinter.	Limestone.	Scrap.	Other materials.	Total.		
		Home.	Imported.							
		(In thousands of tons)								
1939	7,979.8	11,544.6	5,242.9	1,920.6	2,013.7	382.3	857.4	21,961.5	8,706.5	12,731.2
1940	8,204.6	13,722.0	4,113.1	2,425.5	2,605.9	380.9	978.6	24,226.0	9,625.5	14,420.0
1941	7,392.5	15,430.0	1,658.0	2,393.7	2,526.0	472.2	776.6	23,256.5	9,147.3	13,703.4
1942	7,725.6	16,102.0	1,668.8	2,426.3	2,658.8	650.6	769.2	24,275.7	9,501.8	14,375.8
1943	7,186.9	14,704.7	1,402.4	2,349.2	2,393.2	716.7	672.1	22,238.3	8,766.6	13,132.0
1944	6,736.5	12,683.2	2,042.5	2,269.6	2,189.8	607.4	734.8	20,527.3	8,217.3	12,306.4

* Raw and calcined, as charged.

† Calculated on the basis that 100 tons of coal yields 66 ton of coke.

tricts during the war years, the grades of material produced, and the output per furnace per annum are given in Table II, and the production of pig-iron and blast-furnace ferro-alloys in Table III. The reduced output of hematite in the years 1941 to 1944, inclusive, corresponds with the fall in iron-ore imports during that period on account of shipping difficulties. This is reflected both in the consumption of imported ore—particularly in 1941 to 1943—shown in Table IV and in imports of iron ore, according to country of origin, given in Table V.

This last table indicates the revival of imports of ore from Algeria, after the occupation of North

ZINC DEVELOPMENT

The Zinc Development Association in its report for the year 1944-45 states that since it was formed only a year or so before the war, the energies of the Association have so far been largely consumed in work connected with the war effort. As to the future, the fund of information amassed, and the close contacts established since the beginning of the war, afford an excellent basis for future development work, although many new forms of activity have been introduced to meet the more normal conditions now anticipated. At the same time the Association's former work has been intensified.

PRINCIPLES OF JOBBING FOUNDRY RATE FIXING*

By R. F. COATES

The object of any system of incentive payment is to reward the worker with increased pay for increased production, and that thereby an increase in production capacity is effected. A variety of systems of incentives operate in industry, but the system chosen is of secondary importance to accuracy of measurement. Accurately determined standards of performance provide a basis of fairness to both employer and employee. The payment must take into consideration many factors, such as skill required, working conditions, and job peculiarities. In mechanical plants time and motion study is the usual system applied. The physical conditions and repetitive operations readily permit the application of this sound and scientific method. Where, however, production methods are governed by small quantities, size, and complexity, obviously time and motion study cannot be so readily applied.

Jobbing foundry work comprises these wide variations, and, furthermore, highly skilled craftsmen are essential to produce such work. Foundrymen in particular will agree that the jobbing foundry presents a number of complex problems reacting upon rate fixing which are not encountered in the fully mechanised plant. In the production of castings on a jobbing basis the labour cost in most, if not in all cases, represents a substantial portion of the ultimate cost of the casting. It is therefore important that, as far as possible, control should be exercised over the direct labour cost, which, when on an incentive basis, is represented in the piece rate.

Value of the Foreman's Experience

In many foundries the setting of rates is one of the many tasks of the foreman, who from experience is able to set reasonably accurate rates of allowance. It is, however, the practice in most foundries, where the volume of work warrants it, to appoint a member of the foundry staff to assist in this work by the collecting and classifying of data. The adoption of this procedure tends toward accuracy, since a system of control is built up on the basis of past performances.

From the economic aspect excessive allowances tend to reduce the demand. Reduced business follows, which ultimately affects both labour and management. It is therefore in the interest of all parties that piece rates should be soundly based. An important factor which must be borne in mind is that the ultimate aim is a sound casting. Especially in the production of castings in high duty iron this may sometimes involve certain moulding technique which may not be the easiest method.

Conditions under which production is effected are also of extreme importance. Hitherto, much has been heard in foundry circles, and published in the technical Press, concerning foundry conditions and housekeeping. The Author is of the opinion these allied factors have a decided influence both upon production capacity, and the psychological reaction of those engaged in the various grades of foundry work. Obviously, an orderly foundry makes for orderly minds; this, and improved working conditions, cannot but favourably react upon the worker, and consequently upon production capacity. Economic production demands that production time be kept as low as is consistent with the producing of a good commodity. To keep production time to a minimum obviously suggests that the worker must be induced to achieve this by the offer of an incentive. It appears, therefore, that both economic production and the provision of incentives are best achieved by the setting of rates which permit the workers of average ability to earn a balance which is commensurate with their efforts. While this presents difficulties in practice, it is a focal point at which to aim. In order to fix rates with some degree of accuracy, there must be applied sound judgment, supplemented by a systematic set up of references.

However accurate a rate may be, there is ever present the human element, with the natural desire for more, involving negotiation from time to time. There are, therefore, in the Author's view, three principal issues involved in the endeavour to reach a standard of efficiency in rate fixing, namely, judgment and method in basing the rate, a systematic set up of references, and relations and the human factor.

Basing the Rate

It is usually easy to measure the work done by a machine operator. Difficulties, however, arise when the major part, or all of the work, is performed by human effort. In the jobbing foundry the operators are fully skilled craftsmen. A large proportion of their work is of such a nature that it demands care and forethought from beginning to end under varying conditions. These recurring factors are difficult to control, but, nevertheless, they must receive due consideration.

For the purpose of this section, it will be assumed that an order has been received for the making of a one-off job. On receipt of the drawing the first decision made is the method of moulding. Should the order include the making of the pattern discussion with the patternshop staff will decide the nature of the construction of the pattern to meet the requirements of the foundry.

In preparing an estimate of the allowance for a job which may take 100 hours to make, it is obviously not practicable to set down on paper every opera-

*A contribution to a symposium on "Rate Fixing," organised by the East Anglian section of the Institute of British Foundrymen, Mr. D. Carrick presiding. The Author is on the staff of Ransomes & Rapier, Limited.

Principles of Jobbing Foundry Rate Fixing

tion. It is, however, possible to prepare a list of those operations which may be regarded as sectional, namely, core irons, cores, preparation for moulding, ramming bottom, rolling over and jointing, and so on to the final operation of casting. If two or more members of the foundry staff prepare such a list independently, the average in most cases may be regarded as the most accurate. At this stage the set allowance is based upon personal judgment, which, however sound, may at times be erratic. In order to minimise this, the job can now be compared with similar work previously made, assuming, of course, that such records are kept.

It is on the arrival of or completion of the pattern that the allowance may be finally decided. With the pattern and coreboxes in view, more details are noted, and a further check of the original list of operations will prove the need for any adjustment to the original figure. This method is by no means faultless, but, it is contended, that with a reliable file of references, coupled with sound judgment, a reasonable degree of accuracy is achieved.

While in production, unforeseen circumstances arise from time to time—especially in jobbing work. These are usually due either to physical conditions or to modifications to coremaking or moulding methods. When such circumstances arise, investigation will prove as to the need for any adjustment to the allowance.

The Creation of References

Technical control demands regularity in the posting of data, in order that inaccuracies may be detected and corrected. If control over rate-fixing is to be exercised facts and figures are essential for reference purposes to supplement and guide personal judgment, which by itself may at times be erratic. While as much data as possible should be collected and filed, discretion must be exercised in order to keep the system easily workable. Records are justified only in so far as they contribute to control and lead to accuracy. Obviously, more detail is essential concerning the complex rather than the plain castings.

The main facts required are:—Description of the casting; size of moulding box used; the allowance for each section of the work; weight of the casting, and the time taken on each section of the work and by whom. The time taken is vital information. Probably the best and simplest method of obtaining it is by the use of the mechanical time recorder, which involves those on the job in clocking on and off the job card.

For foundry rate-fixing purposes, only the drawing, apart from the pattern, can give it an adequate description. It is, therefore, advisable when practicable to prepare a reasonable copy in miniature from the drawing of a new job. This may be made either in an indexed ledger or on a card. There are distinct advantages in using cards, as one side may be used for the sketch, and the other side for the entering of data. Furthermore, cards facilitate reference, as they can be withdrawn from the file and laid out for comparison. From the Author's experience it appears that the best method is to use cards for the larger and complex work and a ledger for the smaller and plain work, as a proportion in the latter group may be entered in a tubular form with a sketch at the top of the page with the main dimensions lettered.

The grouping of the various classes of work is a matter for the individual. It should, however, be mentioned that since numerals convey no indication of the type of a casting, classification by name or weight offers a suitable method of grouping. It is, of course, essential that care be exercised in classifying work, since if lacking in method, vital information may be overlooked. Furthermore, clarity is also necessary, for this is not only conducive to easy reference, but it considerably eases matters when circumstances arise, involving another party taking up the work.

Relations and the Human Factor

In every sphere of human endeavour, the best results are achieved in an atmosphere of good relations. The importance of industrial relations, in so far as they are connected with incentive payment, may be gauged from the fact that wages to the wage-earner are of extreme importance. Consequently, wages form an important issue in relations between employer and employee. The implications here are that upon rate fixers there rests some responsibility in the establishing and maintaining of good relations within their respective groups. The nature of this work demands high moral standards. It is in direct contact with those within the group that the rate fixed is able to win confidence and respect. According to the method of approach to the individual in all matters involving negotiation, so is determined the measure of success in relations. Sentiment, however, must not take the place of common sense.

There is an inherent selfishness in everybody, and a greater degree of tolerance and vision cannot but tend to arrive at an intelligent solution to any problem. The complexities of the human factor present extreme difficulties, yet no system of incentive payment can ignore it if it is to operate efficiently.

In all craft trades there exist variations in rates and methods of working, which are illustrated in cases where a craftsman regarded as of average ability earns a reasonable bonus, while another, on the same job under equal conditions, earns none. The causes of this variation are in many respects due to innate characteristics of the individual. The setting up of sound systems of craft training may tend to minimise these differences of ability. This theory is based on the reasoning that if over a period a standard of rate fixing is established on the basis of experience and references of past performance of craftsmen of average ability, the potential craftsman should be trained to reach that standard.

Finally, the whole tone and spirit in this field of industrial administration should be one of co-operation among the staff in applying a fair but firm policy, which will assist in the cultivating of an atmosphere among the group, which is free from all suspicion.

DISCUSSION

MR. WARD asked that when Mr. Coates set a bonus rate for a one-or-two-off job, to what number off did he allow that rate to be maintained. Did he allow the original price to stand for larger quantities?

MR. COATES, in reply, said that for large jobs necessitating odd sides, etc., it was obvious that the rate for the first would be proportionately greater than for the second, and so he fixed a price for the first off and adjusted it for any further number off, the extra time on the first being, of course, the set-up time.

MR. HARDY questioned the fairness and accuracy of a time-study man summing up the time for a job from the patterns, etc. He considered that for a comparatively young man and possibly one with limited experience to set up a time against the experience of an old tradesman was demanding too much. Furthermore, he could not conceive that there were many men who were capable of looking at a job and saying such and such a tradesman will make that in so and so time.

MR. COATES agreed that jobbing foundry rate fixers were as prone to errors as anyone, but he considered that a fair estimate to within 10 per cent. could be arrived at. Adjustments had to be made for any circumstances arising which were initially unforeseen, but with the aid of good reference cards a good degree of accuracy was possible.

MR. CARRICK thought that Mr. Hardy was suggesting that a man should know when he started a job what bonus he would get and whether he had adequate time to earn that bonus.

MR. HARDY considered that all-in-all it was a hit-or-miss method, which if it yielded results within 5 to 10 per cent. would be lucky.

MR. COATES, in reply to this and to a similar point raised by Mr. Hammond, said it was the usual practice, so far as possible, to give a man the time for the job in preference to an open card.

MR. CARRICK said it had not been mentioned that when a price was set one would inevitably get reaction from the men. How did Mr. Coates cope with a man who complained about poor time?

MR. COATES replied that if the man brought it up at the beginning of a job he was shown the facts which governed the price set, but if, on the other hand, he had a good case the time was adjusted to eradicate the cause of his complaint.

MR. HAMMOND asked what happened in the event of a large job being scrapped as far as payment was concerned. Was the man or men paid in full with bonus, or at day-rate, or was payment stopped altogether?

MR. COATES said that it was seldom that a job of any great size was scrapped, but in the event of such an occurrence the general ruling was that the men were paid at day rate for the scrap if they were responsible, and at full bonus rate if the scrap was due to reasons outside their control.

A PORTABLE GAS-PRESSURE DETERMINATOR

For the rapid determination of the gas pressure created by moulding sand or cores, a portable gas-pressure determinator has been developed by the Harry W. Dietert Company, of 9330, Roselawn Avenue, Detroit, 4, Michigan. This determinator uses a 1½-in. x 3-in. sand or core specimen which is attached to the stem of the determinator. The specimen is then immersed in molten metal. The pressure of the gas envelope created by the specimen is shown on the gauge of the determinator.

The portable gas determinator makes it possible to measure the pressure of the mould-metal interface gas envelope by a very practical method that simulates mould conditions almost perfectly. The sand or core mixture to be tested is rammed to the chosen hardness by means of the No. 754 sand rammer. A special pedestal is furnished with the determinator which contains a hole to receive a specimen tube ¼ in. outside diameter x 7½ in. in length. The end of this tube projects 2⅞ in. above the special pedestal so that the open end of the tube is ½ in. from the top end of the rammed specimen.

The rammed specimen with the tube may be then dried or baked if preferred or attached to the determinator in the green state. The tube with the specimen on one end is then inserted into the lower end of the determinator. A heat-resisting gasket makes a gas-tight joint. To adjust the tightness of this joint, one turns the handle of the determinator.

The specimen on the end of the tube is then immersed 2½ in. into a ladle of molten metal. The gas pressure created by the material under test is read in inches of water pressure on the dial of the determinator.

This method of test, where the specimen is immersed in the type of metal to be cast, solves many perplexing problems as to the correct test temperature and test condition. Heat conductivity of the metal-mould interface is automatically taken into consideration. It forms a very simple, practical and economical test for measuring the gas pressure created by foundry sand or core mixtures, near the metal-mould interface.

One of the best foundry sand control tests developed to date is the gas-pressure test. This test measures one of the last important links in the chain of sand control. Such tests as fineness, permeability, percentage of facing ingredients, moisture, and mould hardness all are considered finally to secure a desirable pressure of gas envelope surrounding the molten metal in the mould. Measuring the gas pressure is, therefore, a practical step. The portable gas determinator makes this test a valuable control medium available for use by both foundry technicians and practical foundrymen.

MR. T. MAKEMSON has changed his address from Clarendon Hotel, Leamington Spa, to Newbold Pacey Hall, Newbold Pacey, near Wellesbourne, Warwickshire.

EMPLOYMENT OF DISABLED PERSONS

OBLIGATIONS OF EMPLOYERS

The introduction of a quota scheme for the employment of disabled persons was announced by the Minister of Labour and National Service in the House of Commons recently.

The scheme is to start on March 1, 1946, in order to give employers time to prepare for the statutory obligations which will fall upon them under the provisions of the Act.

The starting percentage for the quota scheme is 2 per cent. It is considered desirable to introduce a scheme of this complexity by gradual stages, and a start is therefore being made with the low percentage figure of 2 per cent. as soon as the number on the register in need of the benefits of the scheme is sufficiently large to justify having a percentage at all. The percentage will be raised as soon as that is necessary to facilitate the resettlement of the larger numbers of disabled persons coming on to the register.

The 2 per cent. is the standard percentage for general application and will apply to all employments, unless between now and March 1 a special percentage has been fixed for any industry.

The only disabled people who will count for the purpose of the quota are those who are registered as such under the Act. A person who has not been registered will not count, however serious the disablement and whatever the cause.

Registration Incentive

Registration began on September 25, 1945, and since then the number who have registered up to November 19, is 97,576, of whom 26,209 are not in employment. The numbers registering have thus far fallen below expectations, but the rate of registration is increasing weekly. For those disabled persons who are already in employment and feeling reasonably secure, there is no incentive in the form of an immediate advantage, as the advantage does not accrue until the quota scheme is introduced. After March 1 next the advantage of being registered will be apparent, and it is expected that there will then be a very rapid increase in the numbers of disabled persons already in employment asking for registration.

The employers affected by the quota obligation are all those with 20 or more employees. This figure of 20 or more employees relates to the total of an employer's staff irrespective of where or how they are employed. Employment means contractual employment of any kind.

The obligation to employ a quota does not mean that the employer must discharge non-disabled persons to make room for the disabled; it means that he must take the opportunity when engaging fresh staff to build up to his quota. Accordingly, an employer must not engage a person who is not registered if he is below his quota (or if after the engagement he would be below it), unless the person is a former employee who is entitled to reinstatement or the employer has obtained a permit to engage.

An employer will have to get a permit to engage a non-registered person (except in a reinstatement case) for a quota vacancy, and a permit will not be issued if there is a registered disabled person suitable and available for the job. There is no intention to force upon employers the engagement of disabled persons who are obviously unsuitable for the job the employer has to offer. Permits will be issued by Ministry of Labour Employment Exchanges, and may be for one or more persons, or may be subject to certain conditions. If it is proposed to refuse a permit or to impose conditions which the employer does not like, he can ask for the matter to be referred to a Disablement Advisory Committee, and a decision will be given in the light of the Committee's recommendation. The final responsibility rests with the Minister of Labour and National Service.

No Discharges Without "Reasonable Cause"

An employer must not discharge a registered disabled person "without reasonable cause" if he is below his quota, or if the discharge would bring him below it.

The question whether there is "reasonable cause" for the discharge of a registered disabled person when the employer is below his quota will be referred to a Disablement Advisory Committee before any action is taken to institute proceedings against an employer. An employer will have a right to attend a meeting of the Committee, and the Committee will make a report to the Minister. If the Minister then decides to take proceedings the decision will, of course, rest with the Court before whom proceedings are taken.

The quota for any employer is ascertained by applying the percentage to the total of his employees. As the quota is determined by a percentage, it is not a fixed figure, but will vary with changes in his total staff. So long as the percentage remains at 2 per cent., employers with 20-24 workers will not come under the quota obligation, as 2 per cent. of 24 produces a fraction of less than one-half and the Act provides that this shall be ignored.

Regulations are being made to provide for the records which an employer will have to keep in order to show compliance with the Act.

ALL-BASIC OPEN-HEARTH FURNACES

It will be of considerable interest to both steelmakers and the manufacturers of refractory bricks to know that the problem of constructing open-hearth furnaces with superstructure entirely of basic material has apparently been solved in Germany during the war. The three open-hearth furnaces in the Rochling'sche Eisen und Stahlwerke are constructed in this material and have apparently been giving very satisfactory operation. The manager of the plant has stated to Dr. T. P. Colclough that the bricks used included both magnesite and chrome-magnesite, and that in spite of the heavy duty imposed upon the furnaces in the manufacture of high-class steels, the furnaces gave a life up to 1,400 charges between repairs.

NON-FERROUS CASTINGS*

By G. ELSTON

The term non-ferrous is capable of very wide application. The word "ferrous" is derived from the Latin word "ferrum," meaning iron, so that non-ferrous simply means non-iron. There are many hundreds of alloys in this category, but it is proposed to deal with a small selection of the most commonly used non-ferrous alloys. Perhaps the most outstanding feature or disparity between ferrous and non-ferrous castings is that of price; most non-ferrous castings cost about 10 times the price of ferrous. The primary reason is the cost of raw materials. One ton of scrap steel costs 55s., whereas tin (a constituent of all gunmetals) is selling at the moment for £300 per ton.

The price of pig-iron is approximately £7 10s. per ton, whilst copper, the main element in brasses and bronzes, costs about £60 per ton. Aluminium costs about three times as much as gunmetal, but as aluminium is approximately one-third of the weight, the ultimate cost of a given casting works out about the same. Most non-ferrous castings are charged at a given rate per pound. The high cost of non-ferrous raw materials has several effects on founding practice: (1) Designers keep sections as thin as possible; (2) as much scrap as possible is included in charges; and (3) scrap castings have too high an intrinsic value to be buried and must be broken up.

The basic reasons for the choice of non-ferrous castings are: Corrosion resistance, in the case of aluminium and magnesium, lightness of weight should be added, bearing, *i.e.*, wearing, properties, in some instances strength, and, lastly, ductility and ornamental value.

Sand for Non-ferrous Castings

Coal dust is not used in the facing mixture for moulds for non-ferrous castings; apart from this, most moulding sands used for cast iron may be used for non-ferrous work with certain qualification as to type and technique. For example, oil-sand cores should be used with caution for castings in phosphor-bronze, lead, and white metal owing to the tendency of these materials to search into the sand and sieze the core. The lighter sections usual in non-ferrous work call for great accuracy of cores and assembly, and it is very often desirable to make cores from moulds using stiffened loam thickness pieces instead of a corebox to obtain this accuracy.

Moulds for aluminium castings should be lightly rammed to allow for contraction when the casting is hot, and if dry sand is being used, the casting should be eased as soon as it is estimated it has solidified. Due to the more searching or penetrating nature of the non-ferrous metals, mould dressings have to be mechanically robust if well-finished castings are essential, and best-quality plumbago mixed with China clay and clay is recommended. For aluminium work plumbago and french chalk is a popular dressing.

Melting

Non-ferrous founding is normally denied the use of that most efficient furnace, the cupola, it being generally accepted and applied that contact with coke and gases has a deleterious effect on the product. Gunmetals are very susceptible to internal porosity caused by gas absorption into the molten metal, and, in fact, the specific gravity of gunmetal castings has been found to be affected most directly by the length of time the metal is in the furnace. For these reasons most non-ferrous metals are crucible melted, in furnaces using coke, oil or gas.

Many prejudices against other forms of melting gunmetal, such as rotary and reverberatory furnaces, are slowly breaking down, and many hundreds of tons of excellent quality gunmetal are now melted in non-crucible furnaces. These furnaces also have the great practical advantage of bulk melting, say 1 to 2 tons at a time. The difficulty of obtaining this amount of metal from separate crucible furnaces with the usual size 400- to 500-lb. crucibles does not need emphasis. Also, large pieces of scrap may be included in the charge. Crucible casting also has a working disadvantage compared with ladle castings, in that there is a great deal of radiant heat from the walls of the crucible.

Charging non-ferrous metals into crucibles or furnace is much different from cupola practice. The highest melting point metal must first be introduced, allowed to melt, and, indeed, achieve a superheat before the lower melting point materials are added. If this were not done, in the case of copper and zinc, for instance, the zinc would all volatilise before the copper melted. Some sort of covering for the molten metal is also desirable to prevent or reduce absorption of gases. Charcoal is probably the most popular, though there are now a large number of chemicals available as proprietory covering materials. For gunmetals the addition of a deoxidiser such as phosphorus effects a considerable improvement in the ultimate physical properties of the alloy, and there are also available a number of proprietory fluxes which have a greater or lesser effect, according to their purpose.

Another prejudice broken down is the fallacious theory that gunmetal suffers in quality by repeated remelting. The Author has seen test-bars from Admiralty gunmetal 88-10-2 which had been intentionally remelted 30 times and the test figures were unimpaired by this unusual and drastic treatment. Whilst on this subject of test figures and quality of gunmetal, the scarcity of tin caused by the war has compelled purchasing bodies to accept lower tin contents in their gunmetals and bronzes, with no apparent detriment to the service given by the castings, and the Author would make a strong plea in favour of using 85-5-5-5 gunmetal in place of 82-10-2. For general castings this alloy is equally as serviceable as the more expensive 82-10-2, which contains twice as much tin, and it is more satisfactory from a casting point of view, being much less liable to porosity troubles.

* A Paper presented to the Newcastle-upon-Tyne branch of the Institute of British Foundrymen, Mr. Burrows presiding.

Non-ferrous Castings

Due to the greater liquid shrinkage and extended freezing range of non-ferrous alloys, running and feeding arrangements generally have to be much more extensive than is the case with cast iron. Manganese brass in particular requires considerable measures to ensure adequate feeding and a sound casting, and it is by no means unusual for a casting to require approximately its own weight in feeding heads. A common method of running this alloy, which is remarkable for its strength and corrosion resistance, is to use a small runner at the bottom of the casting with a heavy feeding head. Many moulders resort to rod feeding, but the Author is far from convinced that the practice offers any advantage with manganese brass or, indeed, any other alloy.

The gunmetals require much heavier runners and risers than cast iron, though not as heavy as manganese brass, for instance. A rough guide is that a runner should equal the thickness of the section it joins and be about 1½ times the width. If, when a runner is cut off, a cavity is revealed, the trouble should be overcome subsequently by increasing the size of the runner. A cavity or "drawing" at the ingate is very often interpreted as indicating too high a casting temperature, and indeed a lower casting temperature will often effect a cure of this particular trouble, though this remedy is not to be recommended, as it will almost surely result in the porosity being dispersed over the whole of the casting and give subsequent trouble on water test.

Casting Temperatures

Casting temperatures for non-ferrous alloys are extremely important. They naturally vary with the alloy. For example, heavy sections in gunmetal may cast at 1,145 deg. C. and light sections at 1,195 deg. C. On the other hand, a zinc slab would be faulty if cast above 470 deg. C. Manganese brass should be cast between 950 and 1,000 deg. C., with phosphor-bronzes approximately 1,050 deg. C. and aluminium alloys 750 to 800 deg. C.

Possession and use of suitable pyrometers are essential for consistent work. Optical pyrometers are not suitable for non-ferrous castings on account of fumes and oxide layers, but the apparatus* described by Mr. R. C. Tucker on the Chromel Alumel bare wire type is cheap to use and accurate in service. As the majority of non-ferrous castings are melted in crucibles of relatively small capacity, it is much more necessary for casting purposes accurately to estimate the weight of metal which will be required to make a given casting than in cast-iron work, and particular reference must be paid to the specific gravity of the alloy to be used. For instance, a casting weighing 26 lbs. in iron would be 31 lbs. in gunmetal, 41 lbs. in lead, but only 9½ lbs. in aluminium.

The fettling of non-ferrous castings is more difficult, *i.e.*, more expensive than for either cast iron or steel.

(*Continued at foot of next column.*)

FRENCH MAGNESIUM INDUSTRY

The development of the French magnesium industry is described in an article recently published in the "Journal Du Four Electrique et des Industries Electrochimiques." Two companies, the Compagnie de Produits Chimiques et Electrométallurgiques Alais, Froges et Camargue, and the Société d'Electrochimie, d'Electrométallurgie et des Aciéries Electriques d'Ugine, are the main producers of magnesium, which has in France been used on a large scale only since about 1930. There was a steady increase in output, the two companies producing between them 2,400 tons in 1940, compared with 575 tons in 1935. This resulted in a reduction of the price from about 30 fcs. per kg. before 1930 to 23.50 fcs. at the outbreak of war. In spite of a growing demand on the home market, France started the export of magnesium in 1934, mainly to Czechoslovakia, Poland and Italy.

When the war broke out, French magnesium producers were unable to satisfy the demand, and it became necessary to import large quantities from America. During the occupation of France, the Germans enforced the completion of orders placed by them as well as the French Government. Only one-sixth of the total production was allocated to the French industry, production in itself being on a small scale owing to lack of suitable raw materials, restricted power supply, and sabotage. Production fell from 1,900 tons in 1941 to 800 tons in the summer of 1944, when it came to a standstill.

The production of magnesium was recently resumed, and as deliveries to Germany had been stopped some time before the liberation, stocks of ingots were sufficient to cover several months' requirements. Stocks of semi-finished products are small and there is an urgent need for replenishment. The present output capacity of the French magnesium industry is estimated at 4,500 tons per year. The controlled price is 66 fcs. per kg.

(*Continued from previous column.*)

Non-ferrous runners and risers are bigger than cast iron and the alloys are not sufficiently brittle to allow of knocking them off, neither can they be removed by flame cutting. For large castings, the use of a warding chisel is the only method. For medium work a band saw is often used and, where shape and size permit, the power-driven shear. An abrasive cutting wheel can cut through a 4-in. dia. manganese brass head in 15 secs. and is an invaluable tool where it can be applied.

Removing oil-sand cores from non-ferrous castings is more difficult than from cast iron and steel, because, due to the lesser amount of heat applied to the core by virtue of lighter sections and lower casting temperatures, the oil-sand bond is not destroyed to any appreciable extent and the cores must be removed by breaking out in pieces.

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* "The Immersion Thermocouple in the Grey-iron Foundry" by R. C. Tucker, M.A., *F.T.J., April 26, 1945, page 335.*

ALAR ACTIVITIES

The collaboration of a group of light metal manufacturers, which found its origin in the days of war with the pooling of technical information in the national interest, has resulted in the formation of a development. organisation known as ALAR. Through this organisation the co-operative efforts of the technical staff of each of these manufacturers is now being applied to the peacetime requirements of industry. The purpose of ALAR is, first, to ensure that the present high standard of secondary aluminium alloys is maintained, and secondly, to promote their use by bringing about a wider appreciation of their properties.

During the war the quality and conformity with specification of the greater part of the aluminium used by founders were guaranteed by an accompanying A.I.D. release note. With the return to peacetime conditions, much of the A.I.D. control is disappearing. The advantages enjoyed by the founder under this inspection system are, however, maintained for industrial and commercial applications by means of the control procedure sponsored by ALAR. Under this procedure, which is similar to that employed by A.I.D., alloys are manufactured and inspected in accordance with ALAR regulations, and an ALAR release note is issued to this effect, thus providing the user with an assurance that all the requirements of the appropriate specification have been observed.

ALAR is solely a technical organisation. Its research programme, which includes the development of new alloys, is carried out in close collaboration with other technical and research associations. An important feature of ALAR's policy is the issuing of publications bringing to the attention of present and potential users up-to-date information on the properties and applications of aluminium alloys. A technical advisory service with considerable scientific resources is available without charge to all users of aluminium casting alloys.

COLORIMETRIC DETERMINATION OF ZINC

A photometric method for the determination of zinc in corrosion-resistant steels by the dithizone method is presented in a Paper entitled "Application of Colorimetry to the Analysis of Corrosion-resistant Steels," by LEWIS G. BRICKER, SIDNEY WEINBERG, and KENNETH L. PROCTOR, published in "Industrial and Engineering Chemistry." A general electric spectrophotometer with a slit width of 10 millimicrons was used in developing the method, but it has also been adapted to the use of a Klett-Summerson photoelectric colorimeter using a Klett No. 52 green filter. The method is suited to routine use and 11 samples and a blank can be run daily using two double-funnel racks. By careful attention to details, accurate values, it is claimed, can be obtained.

AT A MEETING of the Forth Valley Industrial Development Council it was intimated that a permit had been granted for the erection of a new ironfoundry in the Falkirk area to manufacture ferrous and non-ferrous castings.

SHEFFIELD MECHANICS' INSTITUTE

A CIRCULAR OF 1832

When examining a bundle of miscellaneous letters dating back to the beginning of the last century, we came across a circular dated September 15, 1832. This was addressed "to the members of the Sheffield Mechanics' Library and the inhabitants of the town generally." The earlier part of the circular reads:—

"We, the undersigned, being deeply impressed with the *importance* of establishing a 'Mechanics' Institute' in Sheffield, earnestly solicit your deliberate attention to the claims which such an Institution possesses on your support.

"The object of this Institution is to supply, at a *cheap rate*, to the different classes of the community, those advantages of Instruction in the various branches of Science and Art, which are of practical application to their diversified avocations and pursuits. This object is proposed to be attained:

"(1) By Systematic Courses of Lectures on Mechanics, Chemistry and other branches of Natural and Moral Philosophy and of the Useful Arts; but more especially those which are immediately applicable to or connected with the different processes of manufacture of this town.

"(2) By the purchase of Philosophical and Chemical Apparatus and other Instruments necessary to the advancement of Scientific Knowledge, to be *gradually* collected as the funds of the Society may allow.

"(3) By Instruction in Writing—the Elements of English Grammar, Composition—the higher branches of Arithmetic, Mathematics, Drawing, and the principles of Mechanics, Chemistry, etc.; to be given in the evenings by competent Masters as soon as a sufficient number have joined the Institute, who are desirous of forming classes for that purpose."

Thereafter follows a little sermon as to the benefits to be derived and the 72 names of the prominent townsmen making the appeal. The circular is addressed to "The Capital," Church Burgess, and the hand-written covering letter should, we think, have been signed by Robert Leader, who was probably the honorary secretary.

We should appreciate from our Sheffield readers any information they may have as to the success of this appeal.

NOTES ON INSPECTION

(*Continued from page* 8.)

kept up to date. A Government inspector may call at any time to check these, and he is also entitled to watch any castings in their various stages of manufacture.

In conclusion, a word about visiting inspectors, as this is by no means unimportant in the writer's estimation. These include consulting engineers, representatives of Lloyd's Register of Shipping, Board of Trade officials, etc., all of whom are naturally sound technicians. If approached in a proper manner they are prepared to co-operate with the foundry in every way. It is therefore the chief inspector's duty to see that they are treated with courtesy and consideration, and the time devoted to this is certainly well spent.

The Author expresses his thanks to the directors of Lake & Elliot, Limited, for permission to publish these notes.

DEATH OF MR. W. B. LAKE

We regret to announce the death, which occurred last Saturday, of Mr. W. B. Lake, founder of Lake & Elliot, Limited, of Braintree, Essex. He recently relinquished his position as chairman and managing director of the company, retaining his seat on the board. Mr. Lake was the son of an Essex ironfoundry owner, but as a young man he turned his attention to the production of steel castings. He saw the business grow from a country jobbing shop into one of the most important steel foundries in the country, due in no small measure to his choice of colleagues. Mr. Lake was the first to use the electric furnace for making steel castings, and later had a similar distinction in connection with this application for the high-frequency furnace. Among other pioneer activities was the initial use of a Sand-slinger in British steel-foundry practice.

Since 1922, when he joined the Institute of British Foundrymen, Mr. Lake took the most profound interest in its activities. He presided over the London branch in 1929, was for many years the treasurer of the Institute, and in 1939 was elected president. The international foundry convention, held in London in that year, attracted an attendance from all over the world, despite the obvious imminence of war. Mr. Lake made a great personal contribution to the success of the event. He received the E. J. Fox gold medal in 1943.

Another activity to which he devoted much of his extraordinary reserve of energy was the organisation of the Steel Castings Association. Whenever, in the future, man sets out to write the history of steel castings, there will be a eulogy of the enterprise shown by Lake in pioneering so many of its stages of development.

Outside his business activities, Mr. Lake was a well-known sportsman. He was a keen fisherman and golfer, while he was also fond of shooting and motoring, being the first owner-driver in Essex. Mr. Lake was a justice of the peace and a prominent Freemason. His success in life was due to a combination of a real pioneering spirit, assiduous application, a profound belief in co-operation, and a gift for friendship. He leaves a widow, three sons and two daughters. The family is still represented on the board of directors of Lake & Elliot, Limited, by Mr. C. J. Lake, whilst a second son, Capt. P. B. Lake, is on the staff of the company. Mr. W. B. Lake was 76 years of age.

GERMAN IRON AND STEEL PRODUCTION RESUMED

The first blast furnace—out of 29—has been restarted in the Saar, at the Voelklingen plant of the Roechling group, now requisitioned by the French occupation authorities.

Steel production has been resumed in the Ruhr, where several plants, notably the Gutehoffnungshütte (Oberhausen) and the Hüttenverein (Dortmund), have received orders to put their rolling mills into operation. The small quantities produced to date have been used on the spot, particularly for the repair of bridges and houses.

FORTHCOMING EXHIBITIONS

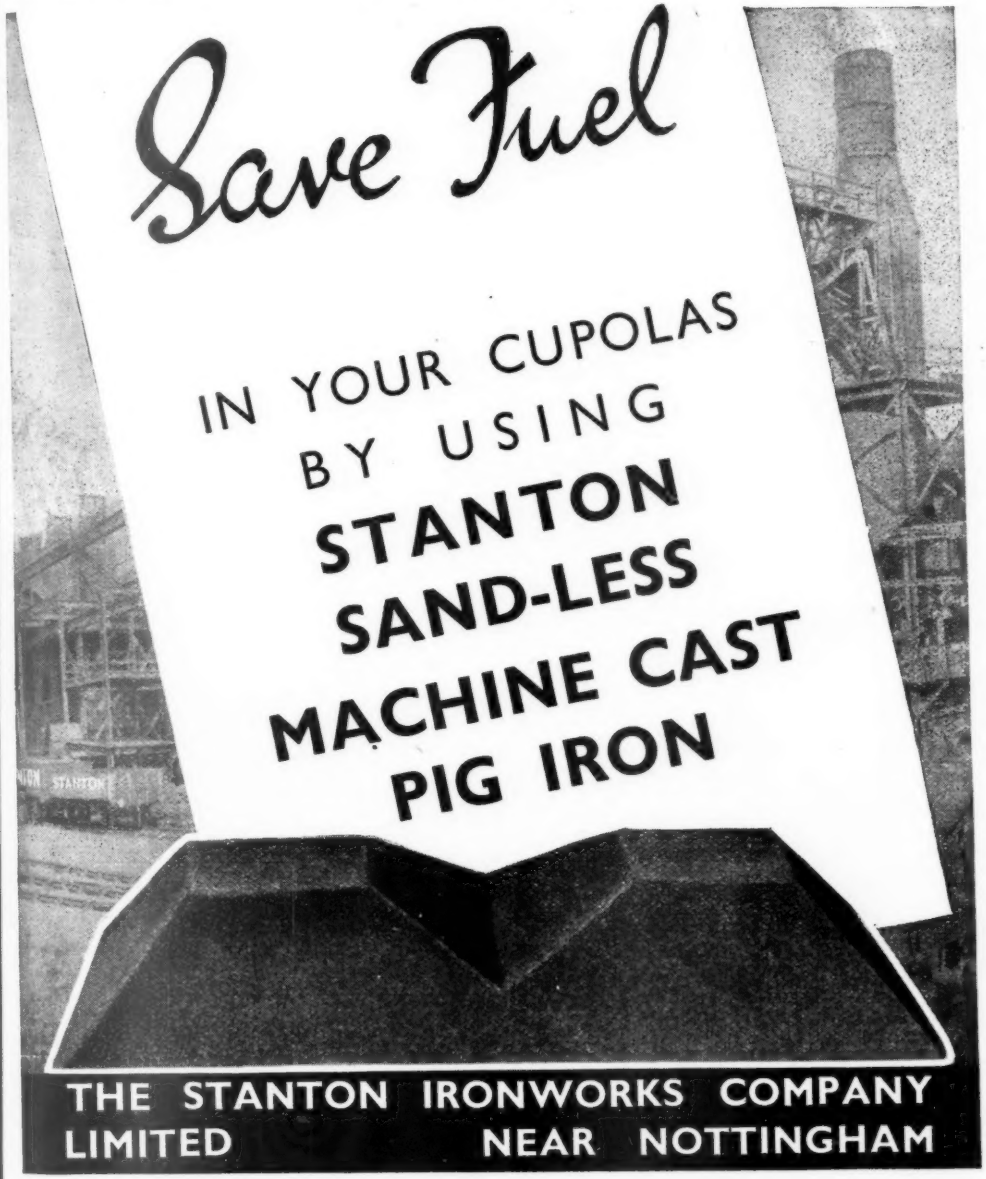
N.-E. Coast Exhibition.—The North-East Coast Exhibition of Scientific and Engineering Inspection Equipment will be held at the Northumberland Road Drill Hall, Newcastle-upon-Tyne, from February 12 to 22 daily from 11 a.m. to 8 p.m. The exhibition is under the auspices of the National Trades Technical Societies, Department of Applied Science, St. George Square, Sheffield, 1, and is under the direction of Mr. D. M. Slorach, M.I.E.I., as hon. director. The chairman of the exhibition committee is Dr. Edwin Gregory, M.Sc., F.R.I.C., M.I.E.I.

"Good Heating for Every Home" Exhibition.—This exhibition of solid smokeless fuel appliances for domestic heating services will be the first large-scale indoor exhibition held since before the war. It is planned to run during March at the Horticultural Hall, Vincent Square, London, S.W.1, and is being organised by the Solid Smokeless Fuels Federation, Grosvenor Place, London, S.W.1, which comprises the National Federation of Gas Coke Associations, the British Coking Industry Association and the South Wales Anthracite and Dry Coal Committee.

EMPLOYMENT FIGURES

Figures issued by the Ministry of Labour show that employment in home civilian industries and manufacture for export increased in the three months ended September by 739,000, an average of 246,000 a month. In October the increase was 341,000, making a total for the four months of 1,080,000. In the manufacturing group of industries the increase in the third quarter of the year was 625,000, an average of 208,000 a month, and in October it was 295,000, a total increase for the four months of 920,000. Manufacture for export accounted for 96,000 of the October increase, compared with an average increase of 67,000 in the preceding three months. At the same time the total working population decreased, mainly because large numbers—of women chiefly, but also of men—are retiring from employment. In October the decrease was 120,000—men 10,000 and women 110,000. Since June the total decrease has been 354,000—27,000 men and 327,000 women. The total working population (excluding private domestic service) in October was 21,217,000, compared with 21,337,000 in September and 21,571,000 in June.

In Luxemburg, at the end of October, five blast furnaces were in operation, three of them on short time. Of the five, two belonged to Arbed, two to the Hadir group, and one to Rodange. To these must be added two blast furnaces at Esch owned by Arbed, which have been put into operation again. In October, one steelworks was active (Arbed-Dudelange), another has just started production at Esch (Arbed), while the steelworks at Differdange (Hadir), after a short strike, has resumed activities. Arbed also propose to resume operations at another steelworks at Esch.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NEWS IN BRIEF

TEES SHIPBUILDERS have achieved during the past year an output of 25 ships of 102,539 gross tons and 80,800 h.p. This is the biggest output of new tonnage in any year since 1930.

THE DIRECTORS of Johnson & Phillips, Limited, are seeking permission to increase the borrowing powers from the present limit of £1,000,000 to £1,600,000 and an extraordinary meeting has been called to consider the necessary resolution.

A REPORT on the local ironfounding industry in relation to post-war reconstruction, for submission to the Government through the Joint Iron Council, was adopted at the annual meeting of the Sheffield and District Ironfounders' Association.

AN AGREEMENT has been signed between Czechoslovakia and Rumania under which Rumania will receive considerable quantities of raw materials for the metallurgical industry, as well as industrial equipment and plant necessary for the restoration of industry and transport.

MR. C. A. PEAKE, Mr. F. R. Harman and Mr. W. McBride have acquired the foundry section of the old-established business of Green & Carter, Limited, Vulcan Ironworks, Kingsworthy, Winchester. The new company is to be known as the Kingsworthy Foundry Company, Limited.

ALUMINIUM, LIMITED, Montreal, announce the formation of a subsidiary fabricating company in the Union of South Africa to provide another export outlet for Canadian produced aluminium. The new organisation, Aluminium Company of South Africa Proprietary, Limited, has been incorporated under South African law. A factory site is being acquired at Pietermaritzburg.

SINCE LAST SEPTEMBER boys joining the Renfrew firm of Babcock & Wilcox, Limited, spend one full day each week at Paisley Technical School. The course of instruction has been evolved by the joint efforts of the firm, the Scottish Education Department, and the Technical School. Pupils study for the national certificate in mechanical engineering and the theoretical course is closely integrated with the practical jobs taught in the works.

AT A DINNER to the workers at the Openshaw, Manchester, works of the English Steel Corporation, Limited, Mr. F. Pickworth, managing director, referred to the company's specialisation in high-grade steel, and said that during the war 50,000 Bristol and 25,000 Rolls-Royce aircraft crankshafts had been turned out, in addition to 10 million tools. The demand for this type of steel was now negligible, he said, but there was no intention of closing the works while other work was available. The company hoped to produce steel for the motor-car industry, the textile machinery makers, and for the plastic industry, Mr. Pickworth added. Maj.-General Readman, who has been appointed a special director to assist in administrating the company's Manchester works, said it was hoped that they would also be able to supply the Dominions with steel.

MR. ELLIS SMITH, Parliamentary Secretary to the Board of Trade, speaking recently at the annual dinner at Birmingham of the Association of Drop Forgers and Stampers, said that a report was expected on the steel industry, containing proposals which would make the industry the most modern in the world. The chief forces which were preventing the maximum technical and organisational efficiency were the so-called trade cycle and monopoly restrictions. The pre-production costs that were imposed on British productive industry which catered for the export trade were a serious factor and needed to be reduced. He asked if it was a fact that all steel firms have to join a certain trade association; that there were means of having the supplies of semi-products cut off if firms did not sell at fixed prices; and that the voluntary associations enforced conditions by rebates, supplies, and other methods to maintain prices.

TEMPERATURE CONTROL IN THERMIT CASTING

There are several alternative procedures for temperature control in thermit casting technique, says R. T. BONNE, writing in a recent issue of "Steel," the most effective being the so-called single-transfer method. With this method, the reaction crucible is tapped and, due to its greater specific gravity, the steel issues first, followed in turn by the slag. The juncture between the steel and the slag pour is usually pretty well defined and when viewed through the conventional welder's glasses, is readily recognised after two or three pours. The steel pour is usually found to be somewhat ragged and spluttery. With the advent of the slag, the physical characteristics of the pour change and it resembles a smooth glass rod. Some users prefer to watch the pour in the receiving ladle and determine the break-point by the change in colour when the slag enters.

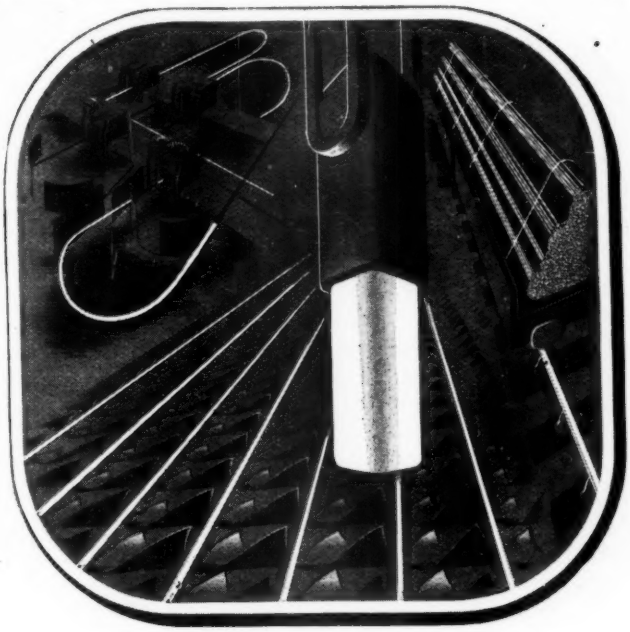
NOVEMBER IRON AND STEEL PRODUCTION

The figures below show British pig-iron and steel production in 1945, up to and including November.

	Pig-iron		Steel ingots and castings	
	Weekly average	Annual rate	Weekly average	Annual rate
	Tons	Tons	Tons	Tons
First half, 1945 ..	133,900	6,963,000	231,600	12,043,000
July	134,800	7,010,000	213,800	11,118,000
August	125,200	6,512,000	186,100	9,676,000
September	139,500	7,255,000	240,700	12,517,000
October	146,100	7,598,000	243,100	12,640,000
November	150,000	7,800,000	247,700	12,878,000

RECRUITMENT OF FOUNDRY LABOUR

The Ministry of Labour and National Service has at last confirmed the statement, first published in THE FOUNDRY TRADE JOURNAL on November 2, to the effect that any young men being no longer essential to non-ferrous and steel foundries are to be directed into iron-foundries instead of passing into the armed services of the Crown.



Design by Victor Reinganum

MOSAICS OF STEEL

NUMBER ELEVEN

Every class of mechanical, electrical and civil engineering makes use of the notably straight bars produced in the Templeboro bar mill of United Strip and Bar Mills. The process is controlled and continuous from melting, cogging and rolling. Special equipment handles the 300 feet lengths of straight bar until cooler. Bars are cut to length and bundled for delivery. Especially noteworthy are the special grades of bar designed for easy and rapid machining and of these, Phoenix Rapid Machining Steel is outstanding.

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PERSONAL

MR. E. J. FOX has resigned his directorship of Crompton Parkinson, Limited.

MR. MARK M. CANSICK, formerly commercial manager of Specialloid Limited, has been appointed secretary of the company.

MR. R. H. BINGHAM and DR. F. TROSTLER have been appointed joint general managers of Huntington, Heberlein & Company, Limited, chemical and metallurgical engineers.

MR. JAMES DALE, of Larkhall, Lanarkshire, consultant in blast-furnace operation and design, will make a tour of the blast-furnace plants of the United States during the next few weeks. He will accompany Mr. Stayman, of Head, Wrightson & Company, Limited.

MR. F. S. FLETCHER, general manager and director of the Teesside Bridge & Engineering Company, Limited, Middlesbrough, has received a presentation from the office and works staff to mark the occasion of his golden wedding. Mr. Fletcher joined the company in 1919.

MR. K. SYMES, manager for many years of the London office of the Yorkshire Copper Works, Limited, retired at the end of the year. His place is being taken by MR. KENNETH BILLINGE, who has been associated with the company for very many years. Mr. Symes remains on the board.

SIR JOHN ANDERSON has intimated to the executive of the Parliamentary and Scientific Committee that he is prepared to accept their invitation to become president of the committee. His appointment in succession to LORD SAMUEL, who is retiring automatically, will be recommended to the committee's annual general meeting.

MR. FRED CLEMENTS resigned his position as chairman and managing director of the Park Gate Iron & Steel Company, Limited, on December 31. He retains a seat on the board as technical and consultant director. MR. ASHLEY S. WARD has been appointed chairman and managing director of the company as from January 1.

SIR HOLBERRY MENSFORTH, owing to advancing age, resigned his seat on the board of John Brown & Company, Limited, as from December 31. Sir Holberry's resignation also extends to his office of chairman and his seat on the board of Craven's Railway Carriage & Wagon Company, Limited, a subsidiary of John Brown & Company, Limited.

MR. G. F. TWEEDY is retiring from the management of the Neptune Engine Works of Swan, Hunter & Wigham Richardson, Limited, the Wallsend shipbuilders, after 53 years with the firm. He is retaining his seat on the board of directors. MR. P. L. JONES, technical manager, has been appointed manager of the Neptune Works and a director of the associated Wallsend Slipway & Engineering Company, Limited, Limited, in succession to Mr. Tweedy. Mr. Jones is president of the North-East Coast Institution of Engineers and Shipbuilders.

SIR HAROLD MORRIS, K.C., president of the Industrial Court, has resigned the appointment after 20 years' service, and the Minister of Labour has appointed SIR JOHN FORSTER, chairman of the National Arbitration Tribunal, to succeed him. Sir Harold Morris's resignation took effect on December 31. Sir John Forster will no longer continue regularly to act as chairman of the National Arbitration Tribunal, but will sit when cases under Part 3 of the Conditions of Employment and National Arbitration Order are before it. Part 3 of the Order requires employers to observe the terms and conditions which have been settled by collective agreement or arbitration for the trade concerned in the district.

Wills

GRINDROD, J., of Rochdale, retired foundry proprietor	£3,593
HUDSON, P., of Harrogate, chairman of Robert Hudson, Limited, Leeds	£167,201

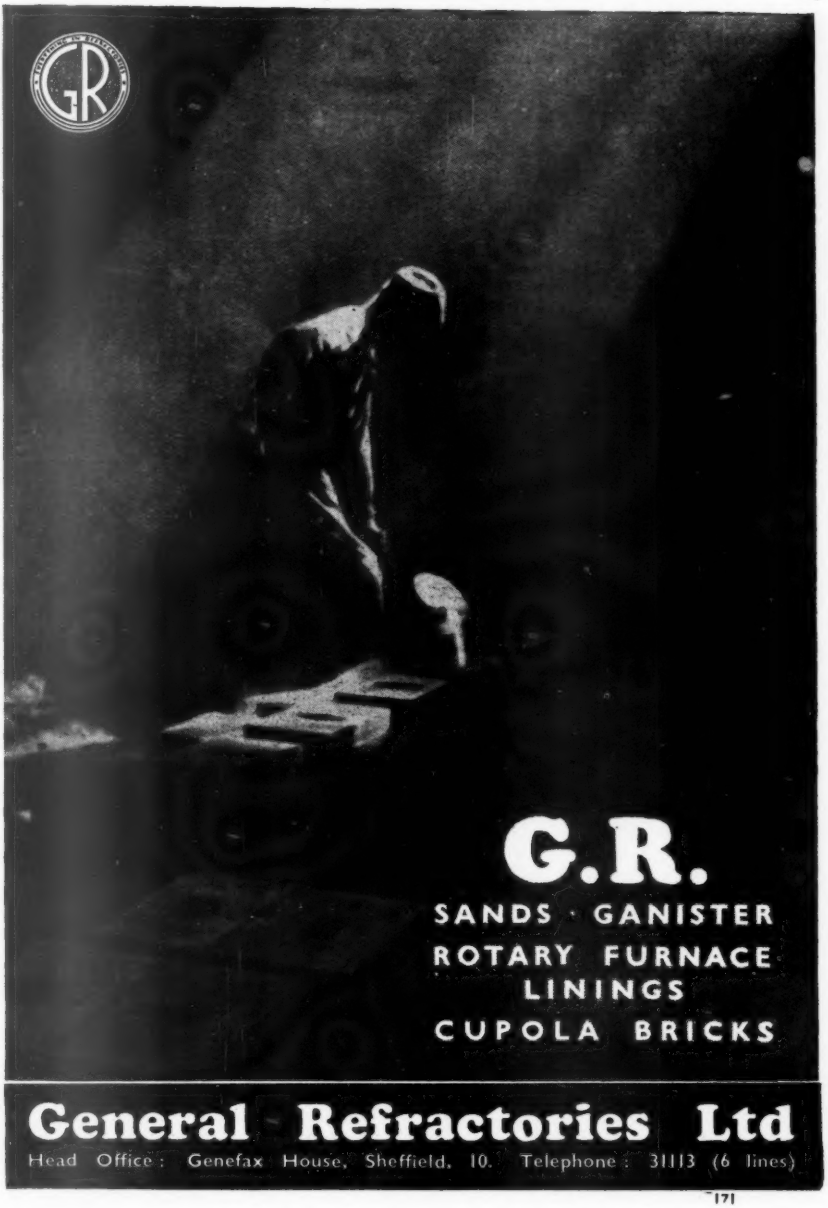
OVERSEAS TRADE DEPARTMENT

The Government have reviewed the responsibilities and mutual relations of the departments principally concerned with the effort to develop overseas trade. Hitherto the Secretary of the Department of Overseas Trade has been responsible jointly to the Secretary of State for Foreign Affairs and the President of the Board of Trade. In future he will be known as the Secretary for Overseas Trade and will be directly responsible to the President of the Board of Trade. The Department of Overseas Trade will be integrated with the Board of Trade and all overseas work will be under the direction of the Secretary for Overseas Trade, but the latter will, of course, be subordinate to the President of the Board of Trade, who remains responsible for trade policy both internal and external.

According to a statement by the Prime Minister, arrangements are being made for close co-ordination of the work for which the Secretary for Overseas Trade will be responsible with the Treasury, Foreign Office, the Dominions Office, and other departments concerned with external economic policy. In particular, arrangements will be made for the training of members of the Foreign Service within the Board of Trade, for their making frequent visits to manufacturing and commercial centres in this country, and for rapid communication between them and the Board of Trade on commercial matters. The Trade Commissioner Service, operating in the Empire and Commonwealth, will be administered directly by the Board of Trade, in consultation as necessary with the departments concerned with Empire matters.

HONOUR FOR BRITISH FOUNDRYMAN

At the first post-liberation meeting of the Czechoslovakian Foundrymen's Association, a resolution was passed awarding honorary membership to Mr. V. C. Faulkner, F.R.S.A., Editor of THE FOUNDRY TRADE JOURNAL and a past-president of the Institute of British Foundrymen.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Raw Material Markets

IRON AND STEEL

Pig-iron prices have been increased by 20s. a ton as from December 31. Steel prices also are up. Prices have for a long time been under review. Authorisation of the increases is given in the Control of Iron and Steel (No. 46) Order, 1945, made by the Minister of Supply. The Order consolidates all previously subsisting Orders except the Scrap Orders and the No. 44 Order relating to the use of tinplate in the production of certain articles. The main purpose of the Order is to provide for higher maximum prices in relation to current costs of production. Prices have in general remained stabilised since 1940 despite higher costs, particularly of coal and imported iron ore, the latter due mainly to increased freights. The special arrangements made with the industry to maintain 1940 prices are being generally discontinued. Limited assistance in the case of freights on imported ores is being continued for the present.

The basis price of pig-iron is increased by £1 a ton. In general the price increase on the main steel products is about 5 per cent. On the more highly finished products the increases are in some cases greater and in others less than this figure. It has been possible, however, to reduce by about £2 per ton the price of motor-body sheets made on the strip mills.

The following amendments have been made in price control:—(*a*) Iron ore and cinder and scale are freed from price control; (*b*) where material is produced to meet unusual requirements, the Minister of Supply may authorise an addition to the maximum price; (*c*) the maximum prices formerly applied to all sales and purchases except where delivery was made outside the United Kingdom or on board a ship for exportation outside the United Kingdom. The exceptions have been widened to include sales within the United Kingdom so long as the material is ultimately exported without having been subjected to any use or treatment.

Other amendments are that electrical stampings are freed from all control; all restrictions on the use of cinder and scale are removed; and restrictions on the acquisition and disposal for export of springs and certain wire products are removed.

The price-list in this issue incorporates the changes resulting from the latest Order. The following is an indication of the extent of the alterations as they affect various products:—

Hematite pig-iron, increase of £1 per ton; hematite pig-iron extras, no change; foundry and forge pig-iron, basis prices increased by £1 and quality differentials adjusted; low-phosphorus foundry pig-iron, increase of £1; Staffordshire blast-furnace low-phosphorus foundry pig-iron, increase of £1 5s.; Scotch foundry pig-iron, increase of £1 5s. and quality extras also increased; cylinder and refined irons, increase of £1; refined malleable pig-iron, increase of £1; cold-blast pig-iron, increase of £1 15s.; blast-furnace ferro-manganese, increase of £1; spiegeleisen, increase of 10s.

Re-rolling billets, basic increased by 7s. 6d. per ton with larger increases on special qualities. Extras list revised; tinplate and sheet bars, no change; bars, sections and plates, increase of 16s. 6d.; uncoated steel sheets, basis price increased by 10s. per ton. Special quality and auto-body sheets from strip mills reduced; coated steel sheets, increase of 25s.; tinplates, increased by 2s. 9d. per box.

Vertically cast and spun iron pipes and specials, increases of from 8d. to 27s. 3d. per yard on vertically cast, and 4d. to 7s. 4d. per yard on spun. Specials increased by £4 per ton; cast-iron drain pipes to B.S.S. 437, increased by approximately 7½ per cent.; cast-iron drain pipe fittings, increased by approximately 7½ per cent.; angle cast pipes, increased by 25s. per ton.

Steel castings are in general increased by 4 per cent. Cast-iron rainwater and soil pipes and gutters are increased by 12½ per cent. and the schedules have been re-edited. Cast-iron brake drums are increased by varying amounts.

NON-FERROUS METALS

Applications for licences from lead consumers are being refused for the time being by the Directorate of Non-ferrous Metals. Apparently, the supply position for 1946 is being considered.

During the four weeks ended December 2, 8,500 tons of copper ore were imported into the six main South Wales ports. The majority of consumers in this country are specifying delivery well ahead, because of the overwhelming number of orders, and a poor labour position. The raising of the copper price in this country, to bring it into line with the world price, continues to give cause for speculation; the position, meanwhile, has not developed beyond the discussion stage.

The demand for zinc sheets shows no signs of slackening, and mills are extremely busy. Export inquiries in this connection are also well in evidence.

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Buckinghamshire Engineering Company, Station Road, Langley, Bucks—£5,000. R. Passold.

Railway Mine & Plantation Equipment—£10,000. W. J. Bruton, Farleigh House, Lawrence Lane, London, E.C.2, subscriber.

J. H. Dunkey (Bloxwich), 53, Smithfield Road, Blakenall, Walsall—General engineers. £1,000. J. H. Dunkey and W. H. Homer.

Haybridge Steel Works (1945), Haybridge Steel Works, Wellington, Salop—£35,000. H. J. Barlow, H. J. Croft, and A. N. Mayer.

Star Engineering Company (Worcester), 8, Star Lane, Bransford Road, Worcester—£1,000. W. A. Gammon, S. Hedworth, and K. A. Lancey.

Metal Products (Carshalton), 31, Pound Street, Carshalton, Surrey—£1,000. G. Atkins, F. W. Clifford, E. S. Cullen, and J. L. Clifford.